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ATROPHIC RHINITIS

TREATMENT WITH ESTROGENIC SUBSTANCES, WITH BIOPSY BEFORE AND AFTER TREATMENT

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Mackenzie [1] in 1884 presented the first scientific evidence of the existence of a nasogenital relation. At this time and subsequently, in 1898,[2] he reviewed in a classical manner the allusions of the amatory and erotic literature and folklore of the past to such a functional association. A brief digest of some of these earlier beliefs, which possess striking historical interest, is presented.

In the Ayur-Veda, the sacred medical classic of the ancient Hindus, indulgence in venery headed the list of causes of nasal catarrh. The term "bride's cold" suggests this point of view. The size and shape of the nose in man were regarded by the early physiognomists as an index of the size of the genitalia. Noses of adulterers were amputated. In astrology Venus was supposed to govern the nose and to preside over generation. Kaspar Bartholin related that Duns Scotus pretended to be able to diagnose virginity by touching the cartilage of the nose.

Mackenzie cited many reports indicative of the existence of "the well-known sympathy between the erectile portions of the generative tract and other erectile structures of the body." Nosebleed, stoppage of the nostrils and sneezing during sexual excitement were related to the erethism of amorous contact and to the consummation of the sexual act. Amatus Lusitanus described a patient who sneezed at the sight of a beautiful woman. Thomas Bartholin and others mentioned patients who sneezed during intercourse. Sneezing has been described as one

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1. Mackenzie, J. N.: Irritation of the Sexual Apparatus as an Etiologic Factor in the Production of Nasal Disease, Am. J. M. Sc. **87**:360, 1884.

2. Mackenzie, J. N.: The Physiological and Pathological Relations Between the Nose and the Sexual Apparatus of Man, Bull. Johns Hopkins Hosp. **9**:10, 1898.

of the signs of pregnancy. The erotic effects of olfactory impressions have been known and employed for ages. As Mackenzie observed:

> Woman, in all ages, from the perfumed courtesan of ancient Babylon to her reflected image in the harem of the Sultan to-day, has appealed to the olfactory sense to bring man under her sexual dominion and to fire his passionate desire.

Mackenzie based his concept of the nasogenital relation on a number of clinical observations. He described the occurrence in healthy women, with no local nasal or gynecologic disease, of an "engorgement of the nasal cavernous tissue . . . with unvarying regularity during the menstrual epoch, the swelling of the membrane subsiding with the cessation of the catamenial flow." He described an "engorgement of the turbinated bodies" which took place at "the onset of the menstrual molimen, reached its acme during the full establishment of the process and disappeared with the subsidence of the ovarian excitement." He called attention to the fact that nasal disorders not infrequently are aggravated during the menstrual epoch. Some nasal disturbances were found to occur only at the time of menstruation. In some instances the nasal discharge may be less during the menstrual flow. It is interesting to note, in reference to the present concepts of atrophic rhinitis, that he observed that in "most cases of ozoena, the foetor is much more pronounced, at times corresponding to that of the uterine flow."

These studies of Mackenzie were followed closely by those of Arviset,[3] Isch-Wall [4] and Joal.[5] Subsequently there appeared the works of Peyer [6] and Eindriss.[7] Fliess's [8] elaborate monograph did not appear until 1897. Of all these studies, the last has been the most frequently quoted and is the best known. Fliess described *Genitalstellen*, small spots of sensitive erectile tissue located at the anterior end of the lower turbinate and in the tuberculum of the septum. These spots correspond well with those described by Mackenzie [9] fourteen years before. Fliess advised local treatment of these spots with cocaine in

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3. Arviset, L.: Contribution à l'étude du tissu érectile des fosses nasales, Thesis, Lyon, no. 383, 1887.

4. Isch-Wall, cited by Mackenzie.[2]

5. Joal: De l'épistaxis génitale, Rev. mens. de laryng. **9**:74 and 129, 1888.

6. Peyer, A.: Ueber nervösen Schnupfen und Speichelfluss und den ätiologischen Zusammenhang derselben mit Erkrankungen des Sexualapparates, München. med. Wchnschr. **36**:38 and 60, 1889.

7. Eindriss: Ueber die bisherigen Beobachtungen von physiologischen und pathologischen Beziehungen der oberen Luftwege zu den Sexualorganen, Inaug. Dissert., Würzburg, 1892.

8. Fliess: Die Beziehungen zwischen Nase und weiblichen Geschlechtsorganen in ihrer biologischen Bedeutung dargestellt, Vienna, Franz Deuticke, 1897.

9. Mackenzie, J. N.: On Nasal Cough and the Existence of a Sensitive Reflex Area in the Nose, Am. J. M. Sc. **86**:106, 1883.

cases of dysmenorrhea, since they were found to be sensitive and turgescent at the time of menstruation.

Recent experimental data bear testimony to the close association of the nasal and the genital system. Karpow [10] reported in 1929 that bilateral turbinectomy in young rabbits resulted in failure of testicular descent and retarded development of the sexual organs. Nemours [11] confirmed Karpow's observations. Jung and Chavanne [12] and Pighini and Porta [13] described modifications in the nasal mucosa following gonadectomy. Rosen and Shelesnyak [14] reported in 1937 that painting or irrigating the nasal mucosa of female rats with a normal estrous cycle produced prolonged diestrual phases, as judged by vaginal smears. The ovaries of these animals contained corpora lutea, and traumatization of the uterus resulted in the formation of deciduomas. Extension of these studies to include the effects of other local agents on the nasal mucosa has been described recently.[15] The following observations were reported: Stimulation with oil of mustard apparently affected the regularity of estrous cycles by altering the follicular phase. Local applications of tannic and of trichloroacetic acid produced in a number of animals a prolongation of the diestrual phase. Anesthetization with nupercaine resulted in the production of pseudopregnancy in a large percentage of cases.

From Montreal, Canada, the city where, coincidentally, in 1897 Mackenzie addressed the British Medical Association on "The Physiological and Pathological Relations Between the Nose and the Sexual Apparatus of Man," there have come, during the past three years, a number of important studies by Mortimer and Collip and their group [16] on the endocrine biology of the nasal mucosa, the endocrine

10. Karpow, N.: Zur Frage des Zusammenhangs der Nase mit der Sexualsphäre, Monatschr. f. Ohrenh. **63**:758, 1929.

11. Nemours, P. R.: Effect of Experimental Bilateral Turbinectomy on the Development of the Testes in the Rabbit, Arch. Otolaryng. **22**:626 (Nov.) 1935.

12. Jung, L., and Chavanne, F.: La sécrétion nasale après castration, Oto-rhino-laryng. internat. **18**:481, 1934.

13. Pighini, G., and Porta, C. F.: L'azione reintegrativa degli estratti anteipofisari ed ovarici sulle alterazioni sperimentali della mucosa ed ossa nasali de castrazione, Valsalva **10**:140, 1934.

14. Rosen, S., and Shelesnyak, M. C.: Induction of Pseudopregnancy in the Rat by Silver Nitrate on Nasal Mucosa, Proc. Soc. Exper. Biol. & Med. **36**:832, 1937.

15. Shelesnyak, M. C., and Rosen, S.: Naso-Genital Relationship: Induction of Pseudo-Pregnancy in Rat by Nasal Treatment, Endocrinology **23**:58, 1938.

16. (*a*) Bachman, C.; Collip, J. B., and Selye, H.: Effect of Prolonged Oestriol Administration upon the Sex Skin of Macaca Mulatta, Proc. Roy. Soc., London, s.B **117**:16, 1935; (*b*) Further Studies of Sex Skin Reactions in the Macaca Mulatta, Proc. Soc. Exper. Biol. & Med. **33**:549, 1936. (*c*) Mortimer, H.; Wright, R. P.; Bachman, C., and Collip, J. B.: Effect of Oestrogenic Hormone Administration upon Nasal Mucous Membrane of the Monkey (Macaca Mulatta),

(Footnote continued on next page)

associations of atrophic rhinitis and constitutional deafness and the clinical value of intranasal applications of crystalline estrogens for these two diseases, particularly for atrophic rhinitis. The endocrine role in the nasogenital relation was established as follows: This group of workers was able to identify characteristic alterations in the nasal mucosa of healthy monkeys during the menstrual cycle and during pregnancy. These were similar, as regards the time of occurrence and intensity, to those seen in the nipples and "sexual skin." The nasal changes were most clearly seen in the middle and inferior turbinates, which showed reddening and swelling or swelling alone. Similar alterations were produced in sexually immature or castrated adult monkeys by hypodermic injections of estrone (theelin) and estradiol and by oral administration of estriol (theelol) and estriol glucuronide. Examination of the nasal mucosa of women during the latter half of pregnancy showed progressive swelling and redness of these tissues. Studies of cranial roentgenograms related a cranial dysplasia thought to be indicative of pituitary disease to the occurrence of atrophic rhinitis and constitutional deafness in many patients. Local application of crystalline estrone or estradiol in corn or sesame oil to the nasal mucosa of male or female patients resulted in gratifying clinical responses. As a rule, 1 cc. of oil solution containing 1,000 international units of crystalline estrogen was applied locally daily for approximately thirty days. In a number of instances constitutional deafness, occurring as a single symptom or in association with atrophic rhinitis, responded to similar therapy.

The value of intranasal application of crystalline estrogens in the treatment of atrophic rhinitis was confirmed by Blaisdell.[17] He presented a few photomicrographs of the mucosa taken during the course of therapy. These were inconclusive. The studies of Hamilton [18] indicated that the effect on the nasal mucosa is not specific for estrogens but may be produced also by androgens. He observed alterations in the nasal mucosa of monkeys and of 8 human beings after the use of testosterone propionate.

ibid. **34**:535, 1936. (*d*) Mortimer, H.; Wright, R. P., and Collip, J. B.: The Effect of Oestrogenic Hormones on the Nasal Mucosa: Their Role in the Naso-Sexual Relationship; Their Significance in Clinical Rhinology, Canad. M. A. J. **35**:615, 1936; (*e*) Atrophic Rhinitis: The Constitutional Factor, and the Treatment with Oestrogenic Hormones, ibid. **37**:445, 1937. (*f*) Mortimer, H.; Levene, G., and Rowe, A. W.: Cranial Dysplasias of Pituitary Origin, Radiology **29**:279, 1937. (*g*) Mortimer, H.; Wright, R. P.; Thomson, D. L., and Clollip, J. B.: Intra-Nasal Administration of Oestrogenic Hormones in Constitutional Deafness, Canad. M. A. J. **40**:17, 1939.

17. Blaisdell, I. H.: The Use of Estrogenic Substances in Atrophic Rhinitis, Laryngoscope **48**:699, 1938.

18. Hamilton, J. B.: Changes in the Nasal Mucosa of Monkeys (Macaca Rhesi) and Humans by Male Hormone Substances, Proc. Soc. Exper. Biol. & Med. **37**:366, 1937.

SURVEY OF MATERIAL

Our study is concerned with a small group of patients (14) with atrophic rhinitis who were treated somewhat similarly to those of the Montreal, Canada, group and sections of whose nasal mucosa before and during therapy were studied in regard to specific histologic alterations attributable to the local action of the estrogens.[19]

The first biopsy specimen in each case was obtained previous to any treatment with estrogenic substances, and the second was taken from twenty-seven to two hundred and sixteen days after, the first treatments with estrogenic substances having been started immediately after the first biopsy. Our period of observation was from April 1, 1938, to Jan. 3, 1939. Some of the patients treated had been followed for from one month to seven years previously; all of these had been using nasal irrigations of 1:6,000 dilution of potassium permanganate previous to this period of observation. Others were new patients. Several had had sinal and nasal operations. No patient complained specifically of deafness and tinnitus, and therefore we are unable to make any report on the response of these conditions to this method of treatment. Each patient had a negative Wassermann reaction of the blood. Four were male and 10 female. Two were Negroes, both of these being male. The average age was 33, and the duration of the disease varied from one to forty years, but in each instance the disease apparently started in early youth. Two patients were in the midst of the menopause, 1 having a rather stormy course with multiple neuroses.

Twenty-two patients started the estrogenic treatment and had the original biopsy, but owing to economic reasons and distance, 8 did not return for the second biopsy. The average duration of treatment between biopsies was eighty-four days; but leaving out 2 cases of treatment for two hundred and sixteen and one hundred and fifty-nine days brings the average down to sixty-three days.

Our method of treatment differed from the Montreal method in that we had the patients irrigate the nose twice daily with physiologic solution of sodium chloride or 1:10,000 solution of potassium permanganate and ten minutes later repeat the irrigation to remove the crusts that had been loosened by the earlier washing. Then 0.5 cc. of estrogenic substance was sprayed into the nose twice daily, to give each patient the equivalent of 1 cc., or 1,000 international units, per day. The atomizer used for such treatment was of the type used by asthmatic patients in obtaining a fine spray of epinephrine hydrochloride intranasally.

Twenty-one of the 22 patients reported clinical benefit, and each wished to continue treatment. The patient with stormy menopausal symptoms stated that she was not improved to the slightest degree. Our inspection of the nose revealed certain marked diminution or complete eradication of crusts in all 14 cases in which the study was completed and in no instance was there detectable the odor characteristic of the disease. The only changes noticeable in the mucosa were a slight increase in hyperemia and a more smooth surface. Patients complaining of a burning sensation in the scalp and occipital headache were relieved of those symptoms. We are unable to state whether the patients' noses were free of crusts because of the more frequent irrigations or because of the estrogenic therapy.

A brief résumé of each case is supplied (table 1).

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19. Two estrogens were employed: amniotin (containing estrone) in corn oil and progynon DH (estradiol) in sesame oil. These were used in a concentration of 1,000 international units per cubic centimeter. Amniotin was supplied by E. R. Squibb & Sons, New York; progynon DH was supplied by the Schering Corporation, Bloomfield, N. J.

HISTOLOGIC CHANGES

What changes might one expect to occur in the structure of the nasal mucosa as the result of the therapy?

Mortimer, Wright and Collip,[16e] who treated a large group of patients with estrogenic substance, stated:

> In time the mucosa presents a more normal appearance; it loses its pale greyish, oedematous character, and comes to have a pink, glistening colour. . . .

TABLE 1.—*Data on Cases*

Case No.	Patient	Race	Sex	Age	Dates of Biopsies	Total Amount of Estrogenic Substance, Cc.	Duration of Condition, Yr.	Complications
1	F. C.	Negro	M	33	6/ 7/38 7/15/38	40	1	
2	E. C.	White	F	47	4/28/38 5/30/38 10/20/38	70	20	Menopausal symptoms; much silver therapy of nose; sinus infections and operations
3	J. F.	White	M	54	11/22/38 12/19/38	30	10	
4	F. B.	White	F	56	11/ 2/38 12/ 2/38	40	30-40	Sinusitis
5	L. M.	White	F	36	8/26/38 9/24/38	30	16	
6	I. C.	White	F	43	4/25/38 6/ 6/38	30	35	
7	R. P.	White	F	65	4/26/38 12/20/38	90	3	
8	A. S.	White	F	24	4/28/38 7/11/38	50	20	Sinus infection; acetanilid poisoning; bromidism
9	P. P.	White	M	54	7/12/38 12/21/38	50	20	Sinus infection; operations
10	A. B.	White	F	35	10/31/38 12/20/38	60	30	Stormy menopause (artificial)
11	C. M.	Negro	M	34	10/31/38 12/20/38	60	3	
12	A. T.	White	F	27	4/ 7/38 6/ 9/38	50	25	
13	J. G.	White	F	17	10/ 7/38 12/28/38	30	1	
14	D. B.	White	F	32	10/18/38 1/ 3/39	30	21	

On the basis of the experimental work on the monkey, already referred to, it is reasonable to suppose that this treatment induces a hyperaemia, an increased glandular activity in the mucosa, and, perhaps, in time, an actual increase or hyperplasia of the mucosal glands. While the clinical appearances would seem to justify such a thought, it is to be clearly understood that so far we can offer no histological evidence of this from biopsy material.

Hamilton [18] studied the effect of androgenic substances on the nasal mucosa. He found that testosterone propionate effected changes in specialized nasal areas in both male and female monkeys. In monkeys and in human beings congestion, swelling and formation of fluid were

observed grossly. Histologically perivascular edema was pronounced in the monkeys. The nasal areas affected were similar to those which exhibit vicarious menstruation.

Certain vacuolar changes called mucification occur in the vaginal epithelium of rodents in the prepubertal state and during pregnancy and the period of activity of the corpus luteum. Similar changes can be produced in spayed rodents by the use of estrogenic substances or of a combination of estrone and progesterone. Moreover, cornification can be produced if large doses of some of these substances are given.[20] Might similar changes take place in the nasal mucosa?

It might be ventured that a ciliated type of epithelium would replace stratified epithelium concurrently with the improvement in the clinical course of the patient. Ciliated epithelium would provide a more rapid movement of secretions.

In the study of the biopsy specimens, therefore, special attention was directed to the character of the surface epithelium, the size and nature of the glandular system, the vascularity of the tissue and the perivascular edema.

The biopsy specimens for the present study were obtained from the anterior tip of the middle turbinate. An idea of the usual structure of this region was obtained from several "control" patients in the course of operations for correction of septal deflections and the like. A good description of this has been given by Heiss [21] and need not be repeated here.

Oppikofer [22] in 1906 reported on the microscopic examination of the nasal mucosa at 200 routine autopsies. Complete longitudinal sections of the middle and the inferior turbinate bone were studied. Several of his observations are pertinent to the present study.

Instead of these bones being covered exclusively with pseudostratified columnar ciliated epithelium, squamous epithelium was observed in 126 of the 200 cases and an intermediate or "transitional" type of epithelium in 39 cases, leaving only 35 cases in which only the columnar type of covering epithelium occurred. If squamous epithelium was present on

20. Robson, J. M., and Wiesner, B. P.: Causation of Mucification and Cornification in the Vagina of the Mouse, Quart. J. Exper. Physiol. **21**:217, 1931. Mayer, R. K., and Allen, W. M.: Production of Mucified Cells in the Vaginal Epithelium of Certain Rodents by Oestrin and by Corpus Luteum Extracts, Anat. Rec. **56**: 321, 1933. Selye, H.; Browne, J. S. L., and Collip, J. B.: Effect of Combined Administration of Oestrone and Progesterone in the Adult Ovariectomized Rats, Proc. Soc. Exper. Biol. & Med. **34**:198, 1936.

21. Heiss, R.: Der Atmungsapparat, in von Möllendorff, W.: Handbuch der mikroskopischen Anatomie des Menschen, Berlin, Julius Springer, 1936, vol. 5, pt. 3, p. 720.

22. Oppikofer, E.: Beiträge zur normalen und pathologischen Anatomie der Nase und ihrer Nebenhöhlen, Arch. f. Laryng. u. Rhin. **19**:28, 1906.

a turbinate bone it lay in the great majority of cases at the anterior tip and extended backward. Hornification occurred occasionally. Squamous epithelium was found in a 7 day old boy. It occurred at all ages and was not proportional to age. The 2 cadavers with the greatest amount of squamous epithelium appeared normal on clinical examination. Those in which ozena had been present during life showed squamous epithelium, but some showed less than many of the normal controls. Intraepithelial glands, budlike formations of goblet cells, were noted in 164 of the 200, more frequently at the posterior ends of the turbinates. The true subepithelial glandular system was lacking in only 1, but was poorly developed in many instances. As a rule, the glands were fairly evenly distributed along the extent of the middle turbinate.

OUR HISTOLOGIC OBSERVATIONS

Protocols of our biopsies before and after treatment in 14 cases were prepared, complete objective descriptions being given. Unfortunately, biopsy specimens taken before and after treatment were not available in the remaining 8 cases; but when only a single specimen was available, it did not differ materially from those described in the more completely studied cases. A low power binocular microscope was employed in addition to the compound microscope to obtain an idea of the general topography, richness of vessels and looseness of tissue. A specimen protocol follows:

E. C. (CASE 2)

E. C. (case 2) Before Treatment.—The epithelium was squamous in places. No ciliated epithelium was seen. Mucous glands were conspicuous, although serous glands occurred. The plasma cell infiltration among the glands was moderate. The fibrous tissue was compact, and fibrosis was present, apparently, in some areas. The vessels were prominent but not conspicuous. (Figure shows a small portion of the specimen.)

After Treatment.—The epithelium was squamous in places. Sometimes the surface cells of the multilayered epithelium were vacuolated. The glands had about the same proportion of serous cells as at the previous biopsy. The cellular infiltration was considerable. The lymphocytes tended to form nodules. Fibrous tissue and vessels were moderate in amount (fig. 2). Comment: No definite differences were noted.

The comments on the "before treatment" and "during treatment" biopsies in the 14 cases in which two specimens were available for comparison were as follows:

Case 1. No definite differences were noted.

Case 2. No definite differences were noted.

Case 3. No definite differences were noted.

Case 4. The specimen after treatment was much more glandular and edematous. Many of the glands were serous, with prominent eosin-staining granules.

Case 5. No differences were noted.

Case 6. More mucous seemed to occur in the glands after treatment.

Case 7. General cellular infiltration was more marked after than before treatment.

Case 8. The epithelium of the excretory ducts showed more mucous, perhaps, after treatment.

Fig. 1 (case 2).—Specimen removed before treatment. Stratified squamous epithelium occurs on the left and "transitional" epithelium on the right. The subepithelial glands are partly serous and partly mucous in this particular field.

Case 9. The inflammatory reaction was more intense after treatment. Cilia were noted in excretory ducts to about the same extent before and after treatment.

Case 10. The glands contained more mucous cells after treatment. So did the "bays" on the surface epithelium.

Case 11. No differences were noted. Ciliated surface epithelium occurred rarely in the specimens.

Case 12. No differences were noted.

Case 13. The surface epithelium showed more mucous cells and subepithelial tissue and more cellular infiltration after than before treatment.

Case 14. The surface epithelium showed more vacuolated cells after treatment, but the difference was not great enough to justify speaking of mucification. Cellular infiltration was severe after treatment and minimal before treatment.

The impression was gained, therefore, that the surface epithelium and the subepithelial glandular system contained more mucous cells

Fig. 2 (case 2).—Specimen removed after treatment. The epithelium is "transitional." The glands have about the same proportion of mucous and serous cells as before. The cellular infiltration is the same. Vascular spaces show well in this field.

after treatment than before. It appeared that the amounts of squamous and ciliated epithelium and the vascularity, as well as various other features, were not altered.

Photomicrographs of portions of the specimens removed before and after treatment (figs. 1 to 8) serve mainly to show the variety of histologic appearances obtainable, and to explain the headings in table

2. Several different appearances were often present in a single section. It is apparent, however, that no perfectly consistent change in any one direction existed. Mucous cells in the glands were present before and after treatment; squamous epithelium predominated before treatment in some instances and after treatment in others; the general appearance of fibrosis or increased density of the tunica propria occurred sometimes after treatment (figs. 3 and 4) and sometimes before treatment (figs. 7 and 8).

TABLE 2.—*Comparison of Biopsy Specimens*

	Before Treatment	After Treatment
Surface epithelium		
Stratified, total extent, all cases	66%	59%
Transitional	24%	22%
Columnar	10%	19%
	100%	100%
Predominantly squamous	11 cases	7 cases
(with keratinization)	3 cases	2 cases
Predominantly columnar	0 cases	2 cases
Cilia noted	2 cases	2 cases
Intraepithelial glands	3 cases	4 cases
Glands (subepithelial)		
Present in	13 cases	12 cases
Ratio of glandular volume	1.2	1
Predominantly mucous	4 cases	3 cases
Connective tissue		
Cellular infiltration		
3 plus	1 case	3 cases
2 plus	5 cases	5 cases
1 plus	8 cases	6 cases
Fibrosis		
3 plus	1 case	
2 plus	3 cases	
1 plus	10 cases	13 cases
0 (polyp-like)	.....	1 case
Vascular system		
Prominent	12 cases	13 cases
Not prominent	2 cases	1 case
Perivascular edema present	6 cases	5 cases

A second method was employed in the study of the biopsy specimens. This consisted of mixing up all of them and analyzing them without knowledge of the patient or of whether the specimen was taken before or after treatment. Table 2 is a summary of the results of this objective type of analysis. Examination of the table shows no startling differences in the specimens before and after treatment. The amount of columnar epithelium present, both in total extent on the combined surfaces and in predominance in individual cases, was slightly greater after treatment. However, the amount of glandular tissue was about the same before and after treatment and the proportion of mucous to serous cells was not changed. The intraepithelial glands were not significantly more numerous after treatment. Thus, the general impression obtained by the protocol method was not obtained by the statistical method.

Fig. 3 (case 9).—Specimen removed before treatment. The epithelium is partly squamous and partly "transitional." A large excretory duct is shown on the left, but the cilia do not appear.

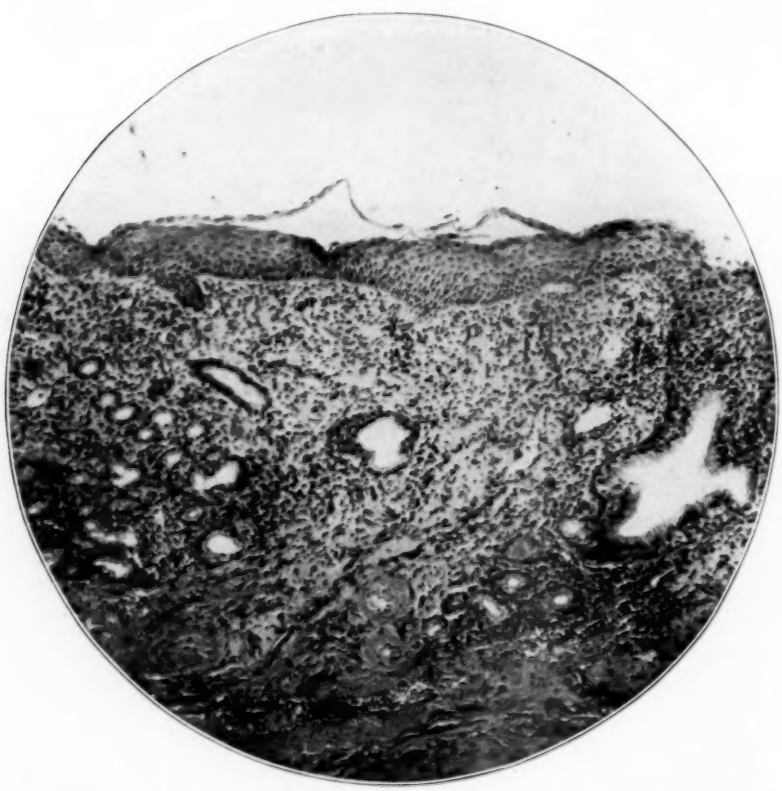

Fig. 4 (case 9).—Specimen removed after treatment. This field shows stratified and keratinized epithelium, glands and rather intense cellular infiltration.

Fig. 5 (case 11).—Specimen removed before treatment, showing ciliated pseudostratified columnar epithelium. The cilia are not clearly seen at this magnification.

Fig. 6 (case 11).—Specimen removed after treatment, showing transitional epithelium.

Fig. 7 (case 13).—Specimen removed before treatment. The covering epithelium is of the stratified squamous type; the subepithelial glands, mainly serous. Dense fibrous tissue is present in the tunica propria.

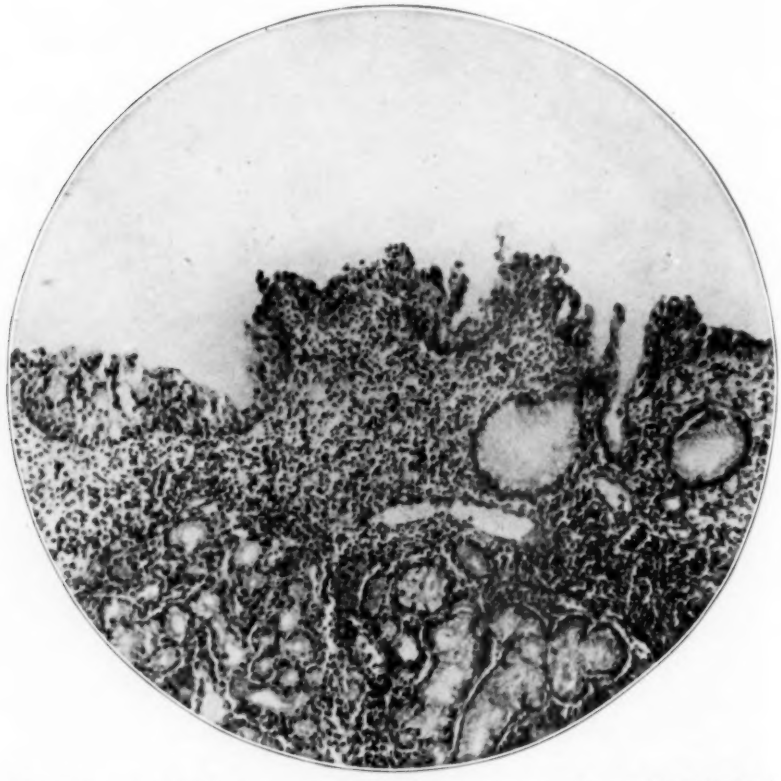

Fig. 8 (case 13).—Specimen removed after treatment. Intraepithelial glands of the surface epithelium can be seen to the left. The subepithelial glandular system shows many mucous cells.

It is to be noted, however, that fibrosis was recorded more frequently before than after treatment. Although this fact does not arrest the attention in the data catalogued by the protocol method, it is possible that the tunica propria is looser, i. e., does contain more fluid, after treatment than before. An attempt to evaluate the prominence of the vessels and of the perivascular edema showed no significant differences before and after treatment. Evaluation of these features as well as of fibrosis is exceedingly difficult. Moreover, the states of vascularity, looseness and fluid content of specimens are subject to many factors, such as the condition of the nasal mucosa when the specimen was taken and the squeezing of the tissue in obtaining it. Statements regarding congestion and edema of excised tissues must be made with caution, unless the findings are obvious at a glance.

COMMENT

It seems clear that no striking changes in the histologic picture in these 14 cases were effected by the treatment. No widespread mucification, cornification or other alteration of the surface epithelium occurred. The subepithelial system was unaltered, and it is questionable that the tissues became more congested or edematous. The protocol method of analysis merely suggested increased function of the mucous glands, and the statistical method merely suggested decreased density of the tunica propria after treatment. It is possible that study of a far larger series of patients might give significance to some of these suggestions. The present observations indicate the absence of obvious morphologic changes.

SUMMARY

Twenty-one of 22 patients treated with estrogenic substances for atrophic rhinitis were clinically improved, both subjectively and objectively, and desired to continue the treatment. In 14 cases biopsy specimens were obtained from the diseased middle turbinate before and during (or after) treatment.

Study of the biopsy specimens taken before and during (or after) treatment failed to reveal obvious changes or definite changes in a single direction. Suggestive alterations included: (1) minimal increase in the mucous character of the glands and (2) increased looseness (edema?) of the connective tissue. The amounts of squamous and ciliated epithelium and the vascularity, as well as other features, were not altered.

NASOGRAPH MIRROR OF GLATZEL AS A MEASURE OF NASAL PATENCY

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NEW YORK

Despite numerous studies of the dynamics of nasal patency, there is no satisfactory method for the quantitative determination of the diameter of the nasal passages. The ingenious method of Sternstein and Schur (1936) measures manometrically the resistance offered to a stream of air during its passage through the nose. It has the advantage of giving a quantitative value of resistance as a measure of the patency of each nostril separately. The method, however, lacks simplicity and depends for its success on the cooperation of the patient. At first thought, it would seem an advantage to measure each nasal passage individually. It will be shown that such measurements taken without reservation do not express the physiologic status of one nostril in respect to the other. As one passage is contracted, the other will carry more than its share of air, but not in direct proportion to the obstruction. The amount of air that may be inspired through one nostril when the other is closed is but a slight indication of the amount that will be expired through it when the other nostril is fully open. Other conditions being constant, a partially obstructed nostril will allow the passage of more or less air according to the patency of its mate.

The Glatzel (1904) mirror as modified by Cocks (1915) was designed primarily to indicate the obstruction of the nasal passages by means of the moisture deposited on a cold metal mirror. The size, shape and position of the deposit on the mirror give a rough index of the patency of the two nasal passages tested simultaneously. The method has the advantages of simplicity and of independence of the cooperation of the patient. The moisture deposits are delineated on the metal plate by means of a crayon and then transferred to a ruled paper for a permanent record.

Our contribution is to modify the Glatzel mirror method so that the results are of quantitative value. The essential difference between the two is that in the original application of the method no cognizance was

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taken of the time required for evaporation of the deposited moisture. Detailed study has shown this determination to be at least as valuable as the original one as a measure of nasal patency. The two together yield information of sufficient importance to warrant serious consideration. In figure 5, *7* and *7 a* show how the evaporation time indicates nasal patency not made obvious by the size of the moisture deposit alone. This phenomenon is shown also by *10* and *13* in figure 4. In *10* the left nostril deposits a spot 14.1 sq. cm. in area, while the evaporation time is 78 per cent of the total. In *13*, the right nostril has been dilated by means of benzedrine, and presumably the left nostril is of the same patency as in *10*, yet the area on the left side has diminished to 2.7 sq. cm. and the evaporation time to 20 per cent of the total.

DESCRIPTION OF APPARATUS

No attempt will be made to differentiate between the original instrument of Glatzel and this one, because the details that have been added are of minor importance and full credit for the clever invention and its application should go to Glatzel. The main difference lies in the use made of the mirror and in the interpretation of the results. The refinements that we describe herein were made necessary because the investigation was of the nature of research. They are not necessary for clinical work, in which fractional changes are insignificant. In the planning of the apparatus, it was necessary to take into account the following factors: (1) the temperature of the mirror; (2) the number of breaths and the total volume of air expired on the mirror, as well as the time taken to expire it; (3) the temperature and humidity of the air in the room; (4) the recording of the spots of moisture directly they are deposited; (5) the measuring of the time of disappearance of the deposit from each nostril, and (6) the nasomirror distance.

The apparatus,[1] shown in figure 1, consists of a mirror of polished stainless steel (*M*), which has been cut out on one of its long edges to fit the convexity of the upper lip. At the circumference of the labial cut is fitted a bow-shaped strip of metal 1 cm. high (*N*), which is notched to receive the nasal septum and to assist the operator in centering the apparatus. The nasal strip (*N*) is removable for sterilizing. Its main object is the maintenance from reading to reading of a constant nasomirror distance of 1 cm. The surface of the mirror is transected by two lines at right angles. From the intersection of these two lines, distances of 1 cm. are marked off to serve as lines of reference. In order that the mirror's temperature shall change as little as possible during the procedure, a chamber (*Q*) of copper is soldered under the mirror, 1 cm. deep and about 1 cm. smaller than the mirror. Through suitable apertures (*T* and *T'*), the chamber is filled with water, while through another is put a small thermometer (*E*). The large volume of water (130 cc.) maintains the temperature of the mirror constant to within 0.2 C. for the maximum period of five minutes consumed by the test. When not in use, the mirror is kept in a bath with a constant temperature of 25 C., accurate to 0.5 C. Ample time is given the mirror to regain the proper temperature, and readings may be made frequently by using alternately two mirrors such as that described.

1. Made by Joseph Becker, New York.

The mirror is attached to a holder, primarily to insure for each patient quick and consistent application of the mirror to the lip in the same plane to the nasal orifices and also to insure minimal handling of the mirror by the warm hands of the operator. The holder (*H*) carries the mirror in a slot and can be fixed by means of a winged screw (*C*). Passing through a hole near the top of the holder rod is the support (*B*) of the brow piece (*D*). By sliding *B* nearer to or farther away from the holder rod while simultaneously moving the mirror (*M*) up or down the apparatus is fitted to the patient, and the relation is maintained throughout each experiment. By recording the positions of *B* and *C* it is possible to reproduce the relative position of the mirror in subsequent tests. The mirror

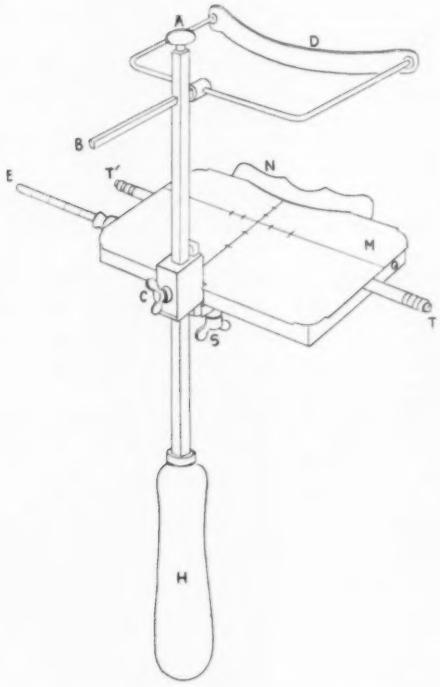


Fig. 1.—The nasograph mirror and holder, described in the text.

is removed from the slot by loosening the winged screw (*S*). Figure 1 shows how the apparatus looks when ready for use.

The recording apparatus consists of a wooden frame into which fits the mirror with its moisture-marked surface exactly in the focal plane of the camera lens (fig. 2). For purposes of economy and ease of handling of the records, a 16 mm. cinematic camera is used, adjusted for a single exposure. Strong illumination insures satisfactory photographic contrast. As soon as the exposure is made, the strong light is extinguished, so that the heat will not warm the plate. By means of a signal marker, the moment of the exposure is recorded on the sooted paper of a kymograph. As each of the moisture spots disappears, a mark is made on the moving paper. Figure 3 shows a typical nasograph record.

PROCEDURE

The subject sits quietly in a comfortable chair for at least fifteen minutes, so that breathing may reach a restful level. Meanwhile, the surface of the mirror is cleaned with alcohol followed by ether, to eliminate all traces of grease. The mirror frame is then adjusted to the patient, and the mirrors, after having been marked with the name of the subject, the date, the number of the experiment and the serial number of the observation, are put into the constant temperature bath. A red crayon or skin-marking pencil, serves admirably. When all is in readiness, the mirror is removed from the bath, dried and lightly polished with a napkin; the nasal strip is removed from its bath of 95 per cent alcohol, dried and put in place. The patient is urged to pay no attention whatever to the proceedings. The kymograph is started, and at the end of the next expiration the mirror is quickly

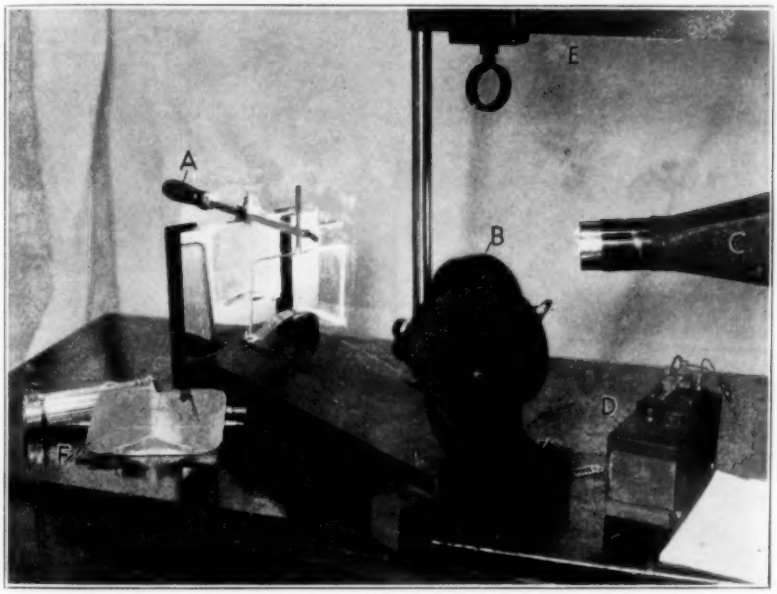


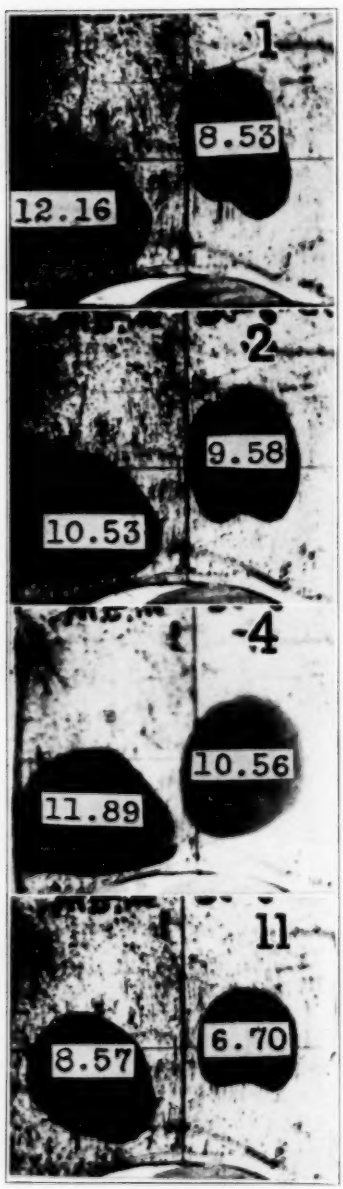
Fig. 2.—Arrangement for photographing the moisture deposits: *A*, nasograph mirror and holder; *B*, cinematic camera; *C*, source of light; *D*, signal marker key; *E*, kymograph; *F*, second nasograph mirror.

adjusted to the nose. At the end of five expirations, the mirror frame is immediately dropped into the photographing slot, an exposure made and the fact recorded on the kymograph paper. The time elapsed between the starting of the drum and the first mark is a rough indication of the time for five breaths. The next signal marks the disappearance of one of the moisture deposits and is indicated with the letter "R" for right or "L" for left, as the case may be. The total time of disappearance of both spots is obtained by adding the times indicated by "R" and "L," while the percentage of each is its time divided by this sum.

The mirror just used is removed from the holder; the nasal tip is wiped and returned to the alcohol; the serial number is changed on the face of the mirror, and the latter is returned to the water bath. Another record may be taken by

Subject, M. G. M.
Date, 10/8/36
Room Temperature, 75 F.
Relative Humidity, 69

RIGHT LEFT



10:35 Subject seated
10:38 Record made
Left: 28% of total evaporation time
41% of total area

10:40 Blowing of nose
10:43 Record made
Left: 36% of total evaporation time
36% of total area

10:57 Inhalation of NH_3 fumes through left nostril for 1½ minutes
10:59 Record made
Left: 48% of total evaporation time
47% of total area

11:35 Record made
Left: 31% of total evaporation time
43% of total area

Fig. 3.—Photographs of moisture deposits (nasograms), about one-third the original size. The dark shadows indicate the deposited moisture. The numbers in them indicate the area in square centimeters. Only a few of the records are shown, for lack of space. (Details are given in the text).

the use of the second mirror with but little loss of time between observations. The procedure never exceeds five minutes, even on humid days. With the average male subject, at a temperature of 22 to 24 C. and a relative humidity of 40 to 60, the average time for a "run" is less than three minutes, so that records may be made every three minutes if necessary. During any one period of experimentation, the temperature and humidity of the room, of which notations are frequently made, change insignificantly, so that successive records are comparable. The greatest single source of error is differences in the depth of breath, or the total amount of air expired in the five breaths, which changes the total time of evaporation of the deposits but leaves the relation of the right to the left nostril unaltered.

In figure 3, *4* shows a greater deposit of water than *2* because between *3* (not shown) and *4* the subject inhaled some dilute ammonia vapor through one nostril. The irritant vapor had forced him to breathe cautiously, resulting in momentary hyperpnea. The total air expirated in the five breaths of *4* was greater than in those of *2*.

RESULTS

All results are reported by means of the following figures: (1) the number of seconds necessary for the complete disappearance of each of the moisture spots from the mirror; (2) the sum of the disappearance time for the left (L) and that for the right (R); (3) the percentile value in terms of the left nostril, and (4) the area of the moisture spots determined from the photographs and measured by means of a planimeter. The shape and position of the spots are mentioned only when they are remarkable or when the experimental procedure has changed them.

In figure 3 is shown the type of graph obtainable from a normal subject under the conditions described. Successive determinations over periods of from one-half to two hours show that the percentile difference between the two nostrils remains approximately constant. The total evaporation time, however, diminishes with the passage of time, and represents a quieting of the breathing during the period of rest. In figure 3 is shown the effect of moderate exercise on this diminished volume. The experiment illustrated by *1* was made as soon as the subject entered the room, while *11* was taken one hour later. It is notable that the percentile values remain constant despite the changes in air breathing volume, as indicated by the total evaporation time of 55 + 139 seconds and 32 + 75 seconds respectively. These results have been confirmed by 65 experiments on 40 subjects, most of them medical students. No experiments on patients are analyzed in the present report. There is appended to each experiment a short history of nasal symptoms as well as the subjective report as to which nostril felt the more patent when the opposite nostril was occluded with the finger. When the percentile difference in evaporation time was less than 10, the subject often had difficulty in deciding which nostril was the more patulous. However, when the difference exceeded 10 per cent, the figures based on the evaporation test and the subjective decision agreed in 100 per cent of the experiments.

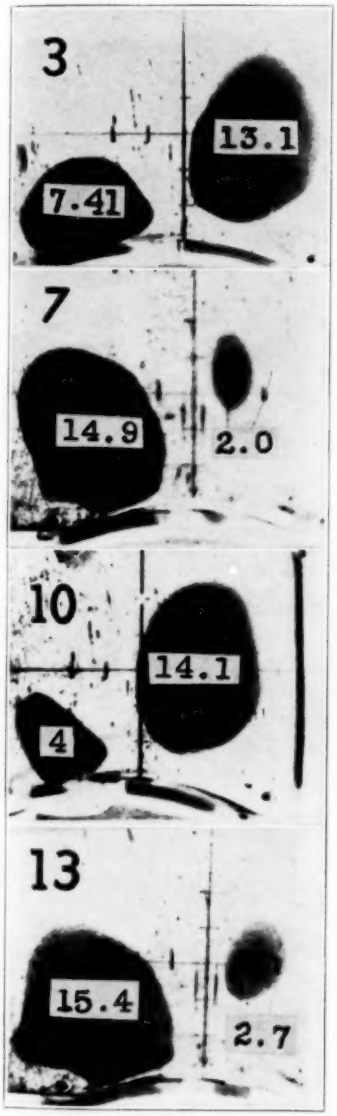
Other conditions being equal, the shape and size of the moisture deposit indicate the shape and size of the nasal passage near the external meatus and bear little relation to the amount of air which is being expelled. Figure 3 shows two records in which the moisture deposits appear approximately of equal relative area in the two nostrils. In *1* the left is 41 per cent of the total area, and in *4* it is 47 per cent; yet the evaporation time indicates much greater obstruction in the left nostril in *1* (28 per cent) than in *4* (48 per cent). This difference in the values of the two measurements is of diagnostic import. In this case, the obstruction to the outflow of air through the relatively obstructed nostril must be far back, near the pharynx, a fact which was easily corroborated by direct examination of the nasal tissues. After the air has passed the obstruction, it has ample space in which to expand to the relatively normal size of the distal nasal passage. The size and shape of the left spot in *4* is therefore approximately normal (the area being within 10 per cent of that in *2*). The relative amount of air that has passed the left nostril has increased from 36 to 48 per cent of the total, however, owing to the inhalation of smelling salts through it.

Determinations have been performed to show the effect on the nasal passage of three factors: (1) the position of the subject, (2) spraying with medicated nasal oils and (3) inhalation of a sympathomimetic drug in the form of a benzedrine inhaler.

1. *Effect of Position.*—When the subject changes from the sitting to the supine position, with the nose pointing straight upward, there is no change in the relative amounts of the moisture deposited on the mirror from the two nostrils. The *total* amount of moisture is changed, however, because with the supine position breathing is more shallow and the total amount of air expired in five breaths is less than when the subject is sitting. On the other hand, when the subject lies on one side, with the face turned so that the plane of the nasal septum is parallel to the floor, partial to complete obstruction of the dependent side is usually produced. That this obstruction is not mechanical, due to polyps, mucus or redundant mucous membranes, is shown by the slowness of its development and by its diminution or abolishment by spraying with sympathomimetic drugs. Of 36 tests, obstruction was obtained in 30, or 83 per cent. Complete obstruction occurred 11 times. If, now, the relative position of the nostrils is reserved, the previously dependent side begins to open and the newly dependent side to close. The findings hold also for subjects who at the beginning of the experiment have partial obstruction on one side. When they lie down with the partially obstructed side down, the obstruction is increased. If the obstructed side is uppermost, it opens gradually, and the dependent side closes (fig. 4).

Subject, M. G. M.
Date, 10/22/36
Room Temperature, 80 F.
Relative Humidity, 63

RIGHT LEFT



3:58 Subject flat on back
4:18 Record made

Left: 64% of total evaporation time
64% of total area

4:19 Subject on left side
4:41 Record made

Left: 14% of total evaporation time
12% of total area

4:42 Subject on right side
4:57 Record made

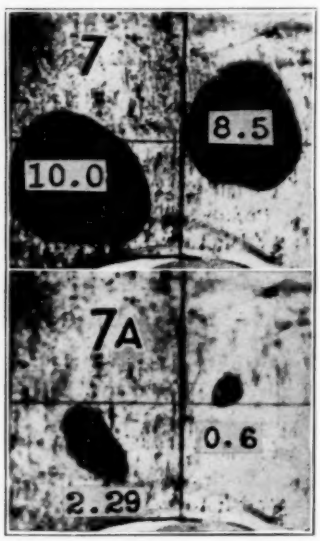
Left: 78% of total evaporation time
77% of total area

5:01 Inhalation of benzedrine through capsule, 2 times into *right* nostril
5:08 Record made

Left: 20% of total evaporation time
14% of total area

Fig. 4.—Photographs of moisture deposits as in figure 3, showing the effects of change in position, as indicated by the appended table. (Details are given in the text.)

2. *Effect of Medicated Nasal Oils.*—While the subject is in the sitting position, one nostril is sprayed with liquid petrolatum, plain or medicated with menthol, or with a "plain" medicated oil bought in the open market. During the spraying, which consists of five compressions of the atomizer bulb, the subject breathes through the mouth, while the opposite nostril is occluded either with a plug of cotton or with the finger to protect it from the medicament. At no time were we able to show objectively any change in the caliber of the sprayed nostril. The size or shape of the moisture deposit did not change, nor did the percentile time of evaporation as compared with that of the opposite and



Same Experiment as in Figure 3

11:09 Record made

Left: 39% of total evaporation time
46% of total area

Record made 69 sec. later, showing the relative areas of the deposits 2 sec. before the left disappeared; that on the right side disappeared 37 sec. later.

Fig. 5.—Same experiment as in figure 3, showing that the area of the deposited moisture is not so indicative of the amount of moisture deposited as is the evaporation time.

untreated nostril. When the oil was medicated with menthol (1 per cent) or when a commercial spray was used, the subject invariably reported that the sprayed side now *felt* more open. In the absence of corroborative objective evidence to this effect, the subjective report is explainable on the basis of the cooling sensation imparted by the medicament, interpreted by the patient as an increase in the amount of air passing through the medicated nostril.

3. *Effect of the Benzedrine Inhaler.*—In order to test out the ability of the mirror method to measure changes in relative patency of the nostrils, the subjects inhaled through the less patent side two inspira-

tions through the capsule of a benzedrine inhaler [2] with precautions (as enumerated) to avoid medicating the opposite side. The results were dramatic, especially when marked obstruction had been present. They are shown in figure 4. When the two nostrils are of about equal patency, the benzedrinized side is made more patulous. When the more open side is benzedrinized, it becomes further opened. When one nostril of a reclining subject has been obstructed by being made the more dependent (fig. 4), that nostril opens in response to the benzedrine and often becomes more patent than the uppermost. When a previously benzedrinized nostril is made posturally dependent, it fails to respond by obstruction to the change in posture. Further studies are in progress to test other sympathomimetic drugs. Since these have to be sprayed into the nostril in solution, it is necessary to check carefully the effectiveness of the solvent, as well as the effect of the active principle.

SUMMARY

An improved Glatzel mirror is described. With this instrument it is possible to measure quantitatively the amount of air passing through the nostrils during quiet breathing by observing the size, shape and position of the moisture deposit from expired air on a cold metal mirror and also noting the time of evaporation of such deposits.

By means of this instrument, called the nasograph, we have been able to show the following facts:

(*a*) Under basal conditions the percentile values for moisture deposits from the two nostrils remain constant unless disturbed by changes in position, drafts, medication or other factors.

(*b*) Change from the sitting to the supine position shortens the total time of evaporation of the deposits but leaves unaffected the percentile differences.

(*c*) A change in the reclining position, so that one nostril is more dependent than the other, caused the dependent nostril to become more constricted in 83 per cent of 36 subjects.

(*d*) Pure liquid petrolatum or "plain" medicated nasal oil does not influence the nasograph values recorded with the subject at rest, nor is it capable of opening the nose when some obstruction is present.

(*e*) Applied by inhalation, benzedrine opens still further a patent nostril, opens a nostril partially closed because of inflammation or posture (as stated under *c*) and prevents closure by posture.

2. Benzedrine is a volatile sympathomimetic amine and was furnished gratuitously by Smith, Kline and French Laboratories.

MOTION PICTURES OF THE HUMAN LARYNX

WILLIAM A. LELL, M.D.
WITH THE ASSISTANCE OF WILLIAM J. SULLIVAN
PHILADELPHIA

Photography of the human larynx has for a long time absorbed the interest of physicians in general and of otolaryngologists in particular. This interest is justified by the accuracy and faithfulness with which an image of an object can be reproduced, the human error in evaluating one's observations by drawings or descriptions thus being eliminated.

Unfortunately, because of the anatomic location of the larynx, photography of this structure has encountered many difficulties. The outstanding problem in the past, for both still and motion picture photography, has been to find a means of proper illumination. A great deal of this difficulty has been overcome today by the remarkable improvement and refinement in the construction of cameras with "faster" lenses and the perfection of new, highly sensitized types of film. These remarkable advances in the field of photography have been a source of renewed interest among laryngologists in this sphere of endeavor, so that today it is nothing unusual to obtain both still and motion pictures of the human larynx, with faithful reproduction of the normal color.

It is remarkable that in spite of the lack of recent refinements early investigators were able to obtain fairly accurate photographs of the human larynx.

Lennox Browne [1] as far back as 1883 presented the first successful photographs of the human larynx before the British Medical Association.

The following year French [2] showed a large series of photographs of normal and abnormal larynges at the International Medical Congress at Copenhagen. The remarkable feature of this attempt at photography was the simplicity of the apparatus. He used a small, single

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Read at the Second Post-Graduate and Alumni Medical Conference of the University of Rochester, Rochester, N. Y., April 9, 1938.

1. Browne, L.: On Photography of the Larynx and Soft Palate, Brit. M. J. **2**:811, 1883.

2. French, T. R.: On a Perfected Method of Photographing the Larynx, New York M. J. **40**:653, 1884; **65**:105, 1897.

lens camera, with a mirror attached, and the source of illumination was sunlight concentrated and reflected into the throat by a truncated cone. Later, he abandoned this form of illumination and substituted artificial light from an arc lamp.

The work of French was followed by quiescence of interest in laryngeal photography until 1919, when Garel [3] reported his technic for securing stereoscopic pictures of the larynx.

In 1925 Clerf,[4] using the Garel method and apparatus, showed a large series of interesting photographs.

As far as can be ascertained from a review of the literature, Heatly [5] was the first to obtain motion pictures of the larynx. His method consisted of attaching the camera to the laryngoscope and photographing the larynx by direct laryngoscopic vision.

More recently, Pressman and Hinman,[6] who also used this method, reported good results.

Lejeune, using a suspension apparatus, obtained beautiful pictures in color of a large variety of laryngeal lesions.

Dintenfass [7] in 1934 showed motion pictures taken by mirror laryngoscopy in several cases.

In 1935 Tucker,[8] who also used mirror laryngoscopy, presented his results before the British Medical Association.

Having seen this method in use, we felt that if properly standardized into an accurate routine procedure it could be of great value in developing renewed interest in laryngeal photography, particularly so because of its distinct advantages over the methods previously used.

Briefly, these advantages may be outlined as follows:

1. One achieves complete control and a wide range of illumination because of the source of light used.

2. The patient need not be subjected to direct laryngoscopic examination or the use of a suspension apparatus.

3. No anesthetic is needed except a 4 per cent solution of cocaine hydrochloride sprayed into the pharynx.

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3. Garel, J.: Nouvel appareil perfectionné pour la photographie stéréoscopique du larynx sur le vivant, Rev. de laryng. **40**:249, 1919.

4. Clerf, L. H.: Photography of the Larynx, Ann. Otol., Rhin. & Laryng. **34**:101, 1925.

5. Heatly, C. A.: Motion Picture Studies of the Larynx, Ann. Otol., Rhin. & Laryng. **40**:434, 1931.

6. Pressman, J. J., and Hinman, A.: Simple Technic for Taking Motion Pictures of the Larynx in Action, Arch. Otolaryng. **26**:526 (Nov.) 1937.

7. Dintenfass, H.: Personal communication to the authors.

8. Tucker, G.: Inflammatory Tumors of the True Vocal Cords: Direct Laryngoscopic Observations, J. Laryng. & Otol. **51**:563, 1936.

4. The patient is completely cooperative, with the laryngeal structures relaxed, which would be practically impossible under direct laryngoscopic examination, and one can thus obtain a relatively more normal picture of the motility of the cords and surrounding structures of the larynx. Also by use of the mirror a wider field of observation is made possible, so that one can visualize not only the unrestrained movements of the cords but the epiglottis, the aryepiglottic folds and the surrounding structures of the pharynx.

5. The adaptability of this method makes it possible to set up the apparatus and take the necessary pictures in a few minutes.

Fig. 1.—View of the larynx by mirror laryngoscopy.

6. The image in the mirror can be accurately brought into focus and visualized at all times during the procedure by the person operating the camera.

There are two distinct disadvantages of the method at present:

1. It cannot be used for persons in whom it is difficult to visualize the larynx because of an overhanging epiglottis.

2. It is impracticable for small children or persons for whom a small mirror has to be used, as it is difficult to visualize and focus an image from a small mirror in the camera, although we have gotten good pictures of several children that were only 7 years of age.

For the past two years we have tried various schemes in order to work out a simplified method, and after many disappointments in our early trials we feel that the procedure at present is sufficiently practical for motion pictures of the larynx in natural color to be taken by any one with average skill in photography.

The basic factor involved in the method is simply a knowledge of the optical principle underlying mirror laryngoscopy, that the angle of reflection must be equal to the angle of incidence. This law is illustrated by the simple diagram in figure 1.

The laryngeal mirror must be placed in the patient's pharynx above and behind the larynx and at such an angle that light received on its surface is reflected downward into the larynx. The rays forming the laryngeal image will return along the same path and be reflected into

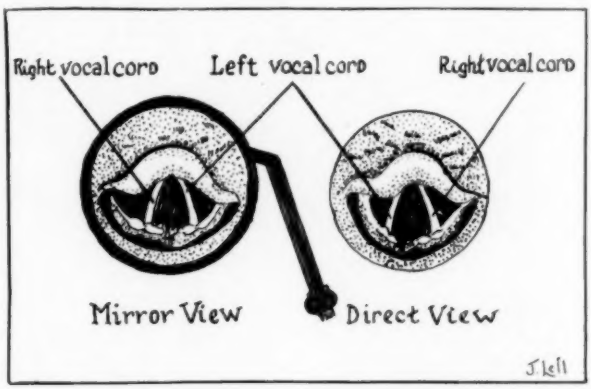

Fig. 2.—Contrast in the appearance of the larynx in mirror and direct laryngoscopy.

the eye of the observer or into the lens of the camera when the latter is adjusted along this line.

Here one must bear in mind that the laryngeal image is a reflected one and that it is therefore reversed anteroposteriorly because the laryngeal mirror is above and behind the opening of the larynx. Also, since the observer is facing the patient, one must keep in mind that the observer's right side corresponds to the patient's left side (fig. 2).

This is in direct contrast to the view obtained in direct laryngoscopic examination, in which the observer's right side corresponds to the patient's right side.

APPARATUS

A Ciné kodak special 16 mm. camera is equipped with a 2 inch (5 cm.) anastigmat lens, f/1.9. Kodachrome type A film is used for color and SS panchromatic for plain photography. The source of illumination is (1) a flood light bulb with

a bull's eye reflector or (2) a 16 mm. projector with a 500 to 750 watt lamp. Special 1¼ inch (3 cm.), or 6 to 7, standard laryngeal mirrors and a head mirror reflector are used.

PROCEDURE

The patient sits erect in a nose and throat chair with an adjustable stool. The camera is set rigidly on a tripod directly in front of the patient, and its height is adjusted so that the lens is in direct line with, and 10 to 12 inches (25 to 30 cm.) from, the mouth of the patient. This distance varies slightly with different patients, depending on the size of the head and mouth. Illumination is provided by a projector or other source of light placed to the right of the patient so that the beam is directed on the head mirror of the operator and reflected and concentrated on the laryngeal mirror, which when held in the proper position and at the correct angle will reveal the image of the larynx.

Fig. 3.—Setup of apparatus used in this procedure.

The field of vision is then brought into focus in the lens of the camera by adjusting the angle of the camera so that it will be in the direct line of the reflected rays (fig. 3).

The diaphragm opening of the lens depends on three factors: (1) the concentration of light, (2) the type of film used and (3) the distance of the lens from the object.

For example, we have found that with an illumination of 750 watts from a projector and with the patient 12 inches (30 cm.) from the camera a diaphragm opening of f/8.0 is most satisfactory when one is using Kodachrome A film.

However, it is recommended that a photometer be used to determine the amount of light that is being reflected into the pharynx in each individual case and the

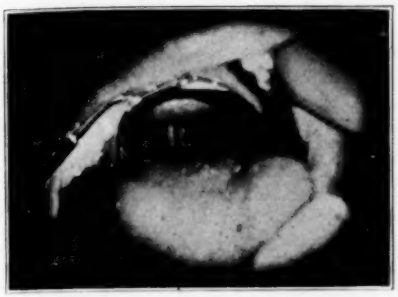

Figure 4

Figure 5

Fig. 4.—Normal larynx, with complete adduction of the vocal cords.
Fig. 5.—Normal larynx, with partial adduction of the vocal cords.

Figure 6

Figure 7

Fig. 6.—Normal larynx, showing the posterior commissure of the vocal cords.
Fig. 7.—Bilateral nodules of the anterior third of the vocal cord.

Figure 8

Figure 9

Fig. 8.—Paralysis of the left vocal cord.
Fig. 9.—Benign stenosis of the larynx.

Fig. 10.—Benign stenosis of the larynx.

Figure 11

Figure 12

Fig. 11.—Infiltrating carcinoma of the larynx.

Fig. 12.—Infiltrating carcinoma of the larynx.

Fig. 13.—Early carcinoma of the left vocal cord viewed posteriorly.

lens setting be made accordingly. By this method, we have photographed the larynges of over 100 patients, with conditions ranging from a normal to an extreme pathologic state.

The photographs here presented are enlargements of single frames of 16 mm. film reproduced in black and white instead of the colors of the original Kodachrome film.

In all our photography the speed of the camera has been 16 frames per second.

CONCLUSION

A simplified method of laryngeal photography is here presented. The larynx is photographed by mirror laryngoscopy and the old cumbersome method thus eliminated.

By this method it is unnecessary to subject the patient to an operative procedure, such as direct laryngoscopic examination and the suspension method require.

The procedure may be carried out in the office without undue preparation and without waste of time.

Laryngeal photography should be encouraged, as it offers an invaluable means of obtaining permanent records of observations, not only useful for future reference but also extremely important for teaching.

Laryngeal photography offers tremendous opportunity for more accurate study of normal and abnormal states of the human larynx.

CONGENITAL TRACHEOESOPHAGEAL FISTULA WITHOUT ATRESIA OF THE ESOPHAGUS

REPORT OF A CASE WITH PLASTIC CLOSURE AND CURE

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Congenital tracheoesophageal fistulas are not common. This is fortunate, for a child so afflicted rarely lives longer than a month after birth, usually succumbing within a few days. The condition is invariably accompanied by esophageal atresia, either above or below the stricture.

The fistula that was found and eventually closed in the patient considered in this report was about ½ inch (1.3 cm.) long and located in the party wall of the trachea and esophagus. It was opposite the ends of the third, fourth and fifth tracheal rings. It was slitlike in appearance and a trifle to the left of the sagittal plane.

At the beginning of the act of swallowing it was closed, but as the larynx receded there was dilatation of the opening, which could be seen from the tracheal side. There was a partial diaphragm of muscle and mucous membrane on the esophageal side, so that when the fistula dilated the posterior wall of the esophagus could not be seen. The opening on the tracheal side was lower than on the esophageal side. Figure 1, a schematic drawing of the tracheoesophageal fistula, shows this. There were spastic reactions of the pylorus and the cardia. For a time, most of the treatment was directed toward dilation of the cardia, by administration of antispasmodics, sedation and mechanical dilation. Also an abdominal operation for the relief of the pylorospasm was done, but with no apparent benefit (fig. 2).

EMBRYOLOGIC AND ETIOLOGIC CONSIDERATIONS [1] AND INCIDENCE

The esophagus and trachea are developed as an outgrowth from the entodermal alimentary canal. The first step in the development of the pulmonary system is a pouching of the ventral wall of the esophagus throughout its entire length. The ventral wall or groove deepens until its edges finally meet and fuse. In this manner, the groove becomes a tube which is separate from the esophagus, beginning at the gastric end

Read at the Sixty-First Annual Meeting of the American Laryngological Association, Rye, N. Y., May 25, 1939.

1. Keibel, F., and Mall, F. P.: Manual of Human Embryology, Philadelphia, J. B. Lippincott Company, 1912, vol. 2, p. 313.

and extending toward the pharynx. This separation is not complete, however, until a bifurcation takes place which gives rise to the pulmonary portion below. The tube above does not as yet separate. At first, the invagination consists of entoderm, but later it fuses with the mesoderm. The trachea is the elongated stalk of the pulmonary system. At an early period two dorsoventral ridges appear at the junction of the trachea with the esophagus.

Keibel and Mall,[1] Reitter,[2] Holderman,[3] Kreuter[4] and Krauss[5] expressed agreement that the cause of the fistula is an interference of mesoderm with entoderm at its site.

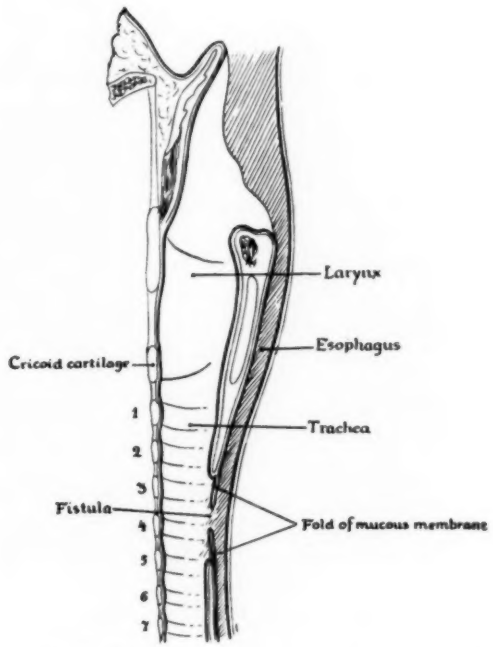

Fig. 1.—Schematic drawing showing the tracheoesophageal fistula.

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2. Reitter, G. S.: A Case of Congenital Atresia of the Upper End of the Esophagus, Radiology **21**:587 (Dec.) 1933.

3. Holderman, A. H.: Congenital Atresia of the Esophagus, with Esophageal Diverticulum and Tracheo-Esophageal Fistula, Arch. Surg. **14**:917 (April) 1927.

4. Kreuter, E.: Die angeborenen Verschliessungen und Verengerungen des Darmkanals im Lichte der Entwicklungsgeschichte, Deutsche Ztschr. f. Chir. **79**:1, 1905.

5. Krauss, F., in Nothnagel, H.: Specielle Pathologie und Therapie, Vienna, A. Hölder, 1902, vol. 16, p. 96.

The fusion of the tracheoesophageal septum differentiates the esophagus and the trachea into two separate structures. Failure of this development results in the anomaly. However, most fistulas of the esophagus are just above the bifurcation of the trachea, for that is the last place to fuse in the development and differentiation of the trachea and esophagus. Almost all the case reports [6] mentioned the presence of other defects, such as atresia of the esophagus, absence of the esophagus, pouches of the esophagus above or below the bifurcation of the trachea, double esophagus, imperforate anus, double uteri, deformities of the phalanges, an anomalous right subclavian aorta arising from the descending aorta, abnormalities of the hand or heart and extra ribs.

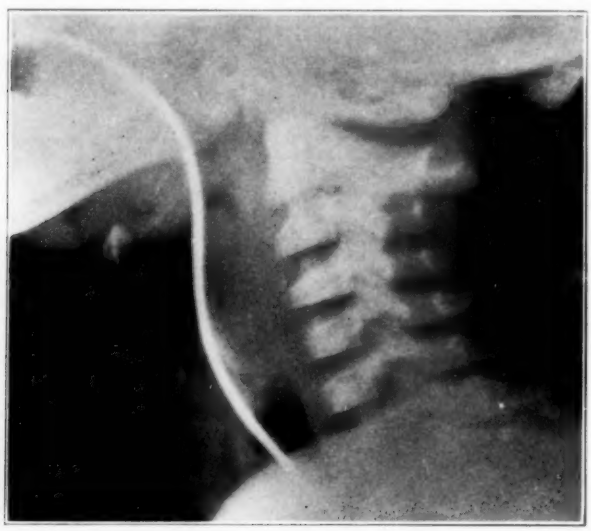

Fig. 2.—Roentgenogram showing a ureteral catheter passed from the larynx through the fistula into the esophagus.

Rosenthal [7] concluded that the development of the anomaly seems to rest on the early fundamental change in the entodermal cells that give rise to the esophagus and not on primary concomitant abnormalities. This change may be genetic.

MacKenzie [8] stated that "the same male occasionally produces a similar deformity in the offspring of different females. There is no instance on record in which the same female has, by different males, given birth to infants with a similar deformity."

6. O'Hare, H. A.: Imperforate Anus and Tracheo-Esophageal Fistula, Pennsylvania M. J. **40**:914 (Aug.) 1937.

7. Rosenthal, A. H.: Congenital Atresia of the Esophagus with Tracheo-Esophageal Fistula, Arch. Path. **12**:756 (Nov.) 1931.

8. MacKenzie, M.: A Manual of Diseases of the Throat and Nose, New York, William Wood & Company, 1884, vol. 2, pp. 223 and 230.

In giving a detailed report regarding a child with a two pouch type of deformity of the esophagus, he related the case of a father whose children by two different wives had similar deformities; both children died within nineteen days.

All the case reports of Holderman, Mathien and Goldsmith,[9] Reitter, Rosenthal, Plass,[10] Kasselbohm and Schreiber,[11] McNamara and Lytle [12] and many others have described lesions of the esophagus with fistulas into the trachea in the neighborhood of the bifurcation of the trachea and with an accompanying malformation of the esophagus.

A case report found in the literature and dated 1696 was cited by McClellan and Elterich.[13]

Up to 1917 Plass, who reviewed the subject thoroughly, found 204 cases. Reynolds and Morrison [14] placed the number at 214 in 1921. In 1922 Steffen and Willard each reported a case, making 216. McClellan and Elterich added a case, and then Holderman [3] reported another case, so that by 1927 a total of 218 cases had been reported. O'Hare in 1933 reported a case and brought the number up to 281. Rosenthal in 1937 reported 3 cases. The rarity is probably due to faulty diagnosis, as shown by Brenneman, cited by Holderman.

Probably 300 such cases have now been reported in the literature.[15]

However, there have been few, if any, reports of cases in which the fistula was high and atresia or deformity of the esophagus was not present. This type of tracheoesophageal fistula must, indeed, be a rarity, as Terracol [16] stated in his comprehensive treatise on diseases of the esophagus.

REPORT OF CASE

The following history was submitted by Dr. Raymond L. Sippel, the patient's father:

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9. Mathien, A., and Goldsmith, H. E.: Congenital Atresia of the Esophagus with Tracheo-Esophageal Fistula, Am. J. Surg. **22**:233 (Nov.) 1933.

10. Plass, E. D.: Congenital Atresia of the Esophagus with Tracheo-Esophageal Fistula Associated with Fused Kidney: A Case Report and a Survey of the Literature on Congenital Anomalies of the Esophagus, Johns Hopkins Hosp. Rep. **18**:259, 1919.

11. Kasselbohm, F. A., and Schreiber, M. J.: Tracheo-Esophageal Fistula and Complete Esophageal Stenosis of the Newborn, Am. J. Obst. **32**:509 (Sept.) 1936.

12. McNamara, F. P., and Lytle, C. C.: Finley Hospital Clinico-Pathologic Conference, J. Iowa M. Soc. **26**:526 (Sept.) 1913.

13. McClellan, R. H., and Elterich, T. O.: Congenital Atresia of the Esophagus: Report of Two Cases, Arch. Pediat. **51**:171 (March) 1934.

14. Reynolds, R. P., and Morrison, W. W.: Congenital Malformations of the Esophagus, Am. J. Dis. Child. **21**:339 (April) 1921.

15. Ross, F. E., in discussion on O'Hare.[6] Imperatori, C. J., and Burman, H. J.: Diseases of the Nose and Throat, Philadelphia, J. B. Lippincott Company, 1935, p. 557. Ross stated that he had had 6 such cases up to January 1936.

16. Terracol, J.; Baumel, J., and others: Les maladies de l'œsophage, Paris. Masson & Cie, 1938, p. 127.

"*Past History.*—Robert R. Sippel, born prematurely on Sept. 23, 1931, weighed 5½ pounds (2,494.6 Gm.) at birth. In September 1937 he weighed 34 pounds (15.4 Kg.). At the time of writing (April 1939) he weighs 44 pounds (20 Kg.).

"The child was difficult to feed since birth; he could tolerate only thick feedings. Administration of atropine sulfate was started during the first few weeks of life. He had bronchopneumonia at the age of 6 months (probably because of aspiration), at the age of 2 years and at the age of 5 years. His sleep was always disturbed because of a cough.

"*Laparotomy in 1936.*—A single adhesion, about the width of a match stick, which stretched tightly across the pylorus and caused retention of food, was divided. A series of gastrointestinal roentgenograms showed four hour retention. In comparison with the results of a series made the year before there was a decided delay in the emptying time.

"*Dilation of Esophagus.*—Dilation of the esophagus (cardia) was done four times by Dr. Louis H. Clerf, Jefferson Hospital Annex, Philadelphia, in 1936.

"The difficulty in retaining food became greatly aggravated at this time; the patient would swallow a certain amount of food or liquid, and after a few minutes the entire amount, together with an extremely large amount of thick, tenacious mucus, would be regurgitated; this was not accompanied by nausea. The child would immediately return to the table and attempt to eat again, after which the same process would be repeated.

"There were intervals sometimes as long as ten to fourteen days when a great deal of food was retained. It was because of this regurgitation that he was taken to Dr. Clerf in Philadelphia.

"The dilations by Dr. Clerf seemed to improve him, but they were exhausting. At that time he was 4½ years of age and weighed between 25 and 30 pounds (11.3 and 13.6 Kg.), so that in spite of Dr. Clerf's advice they were discontinued after the fourth dilation.

"*Tonsillectomy.*—This was done in 1937.

"*Dilation of Esophagus and Subsequent Course.*—Dilation of the esophagus was performed twice by Dr. Girard F. Oberrender, of New York, in October 1937. At that time the symptoms, which had not been too strongly marked, became greatly exaggerated, and for three days the patient retained practically no food or liquids. He was then admitted to the New York Hospital under the care of Dr. Oscar M. Schloss. After a series of gastrointestinal roentgenograms and further study, he was referred to Dr. Oberrender at Lenox Hill Hospital. At that hospital, the esophagoscope was used twice with the patient under anesthesia induced by avertin with amylene hydrate, which had to be reenforced by general anesthesia. It was then decided to adopt the procedure of having him swallow a long string on which to thread a bougie, the string to guide the bougie through the esophagus.

"A short time after beginning the swallowing of the string he did not do well, although he continued to swallow the string until 12½ yards (11.43 meters) had been swallowed. No food or liquids were retained, and the cough became very annoying. In the meantime, the nurses' notes stated, 2 yards (1.83 meters) of string was recovered from the rectum. This excess string was cut off with a scissors. The patient was taken home and became progressively worse, coughing almost continuously and retaining no food and practically no fluids.

"This continued for three days, when he was seen by Dr. Daniel S. Cunning of New York, who made a tentative diagnosis of abscess of the lung. He was admitted to the Manhattan Eye, Ear and Throat Hospital on November 4, and further examination disclosed a piece of string in the larynx.

"On November 5 an attempt to remove this string resulted in sudden asphyxia, and an emergency tracheotomy was performed by Dr. Cunning. The patient was immediately taken to the bronchoscopic room and 9½ yards (8.69 meters) of string was removed from the right bronchus by Dr. David Jones. The remainder, 44 inches (112 cm.), was removed five days later by Dr. Jones. The entire amount of string removed measured 10 yards and 26 inches (9.8 meters).

"The patient was discharged from the hospital on December 27. During all this time he was unable to swallow any food or liquids and was fed by means of a Levine tube. In spite of his acute illness, he was gaining weight because of a diet of high caloric content and good nursing care.

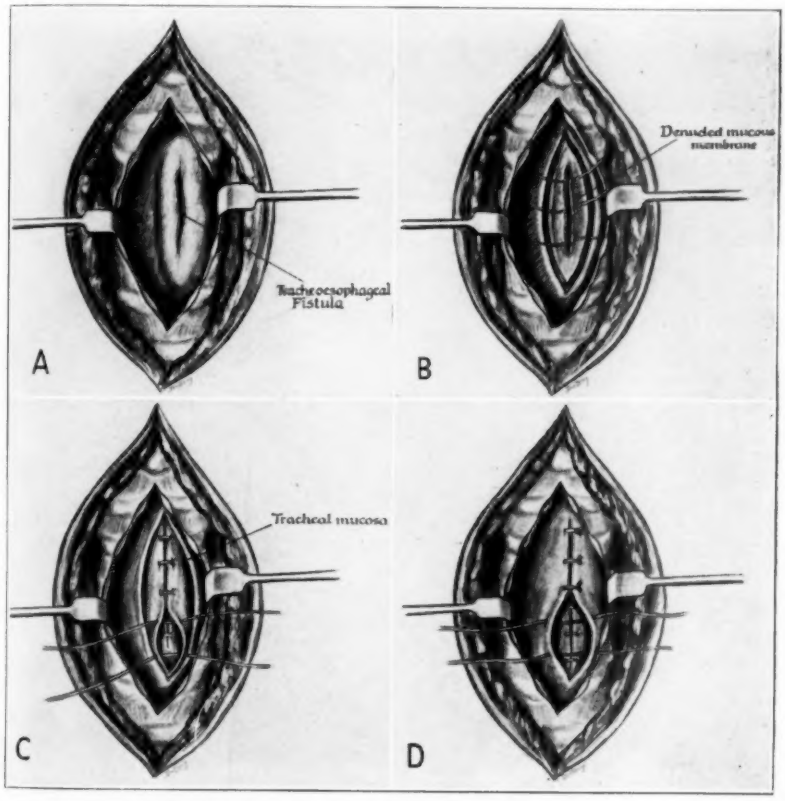

Fig. 3.—*A*, tracheoesophageal fistula exposed and tracheal walls retracted; retraction inverts the posterior tracheal wall and the fistula into the lumen of the trachea. *B*, elliptic incision encircling the fistula; the shaded area shows undermining of the tracheal mucosa; the edges of the fistula were freshened with denudation of adjacent mucous membrane. *C*, party wall, including the submucosal tissues sutured together, burying the fistula; tracheal mucosa as yet not sutured. *D*, tracheal mucosa being approximated.

"The patient was admitted to the Chevalier Jackson Bronchoscopic Clinic at Temple University Hospital on Feb. 5, 1938. He was acutely ill, with a temperature of 104 F., coughing almost continuously and expectorating more than a pint

of sputum a day. The physical signs were those of bronchopneumonia or of an acute tuberculous process. The acute condition gradually subsided, and the temperature finally reached 99 F. Although the diagnosis of tuberculosis had been made, Dr. Cunning insisted on the patient being examined with the bronchoscope, and on February 16 this was done by Dr. C. L. Jackson, and a large tracheoesophageal fistula was found. This observation was later substantiated by roentgen findings; the fistula was localized at about the level of the fifth tracheal ring. The patient was discharged from Temple University Hospital on February 24.

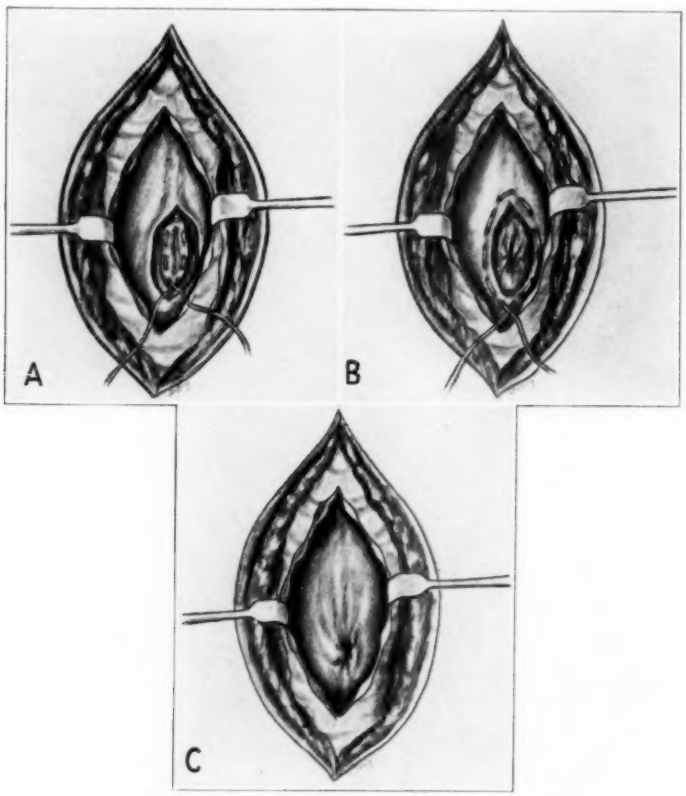

Fig. 4.—*A*, remains of the fistula exposed; purse string suture inserted in the esophageal wall after denudation of the edges of the fistula. *B*, suture drawn together and purse string suture placed in the tracheal mucosa. *C*, suture drawn together, showing some deformity of the posterior tracheal wall.

"He had been at home about two weeks when another attack of acute bronchopneumonia (aspiratory) caused his parents to seek immediate aid. He was readmitted to the Manhattan Eye, Ear and Throat Hospital on March 10, under the care of Dr. Charles J. Imperatori.

"After the acute condition had subsided, Dr. Imperatori was successful in passing a ureteral catheter through the tracheal fistula and into the stomach. A roentgenogram was then taken with the catheter in place, so that the presence of the fistula was proved and more accurate localization obtained.

"The patient was operated on by Dr. Imperatori on March 18, 1938, for closure of the fistula. He was still unable to swallow food or fluid after this operation, and on May 11 a second operation was performed. While at the first operation the fistula had been found to be about ½ inch (1.3 cm.) in length, the second time it was of such size as to admit only a small probe. The remaining fistula was closed with a purse string suture of chromic gut and a second purse string suture invaginating the first layer of sutures.

"The tracheotomy tube was not inserted at the second operation.

"Since then the child has been able to eat and swallow liquids and solid food. The only difficulty experienced is that the process of eating is slow; he may still have some cardiospasm, but the tracheoesophageal fistula has been entirely closed."

Comment.—The diagnosis was originally cardiospasm and pylorospasm, and there was definitely confirmed diagnosis of many attacks of bronchopneumonia, undoubtedly aspiration pneumonias.

Roentgenograms of the chest, because of repeated attacks of food aspiration, were confusing. This, coupled with high temperature and emaciation, suggested a diagnosis of tuberculosis.

Tracheoscopic examination revealed the fistula into the esophagus.

The accident of the swallowing of the string and its removal was a near tragedy. The severe coughing following the swallowing of the string should have suggested the possibility of its being in the trachea. When told of this, I ventured that the string had been looped in the larynx, although in a general discussion it was suggested that a fistula might be present. The fistula was slitlike, and it is possible that there was sufficient sphincteric action of the upper fibers of the cricopharyngeus muscle or stretching of the tissues during the act of swallowing to keep the fistula closed most of the time (fig. 4*C*). It appears that after the "string swallowing," with regurgitation of the string through the fistula into the respiratory tract, there was sufficient disturbance of the fistula to destroy its sphincteric action. There was, undoubtedly, at times severe cardiospasm.

The first operation to close the fistula, which was done on March 18, 1938, and is shown in figure 3, was performed with the idea of not causing any change in the trachea or the esophageal lumen. It was almost a success.

The second operation (fig. 4) was done on May 11, 1938, and the remaining fistula was so small that a purse string suture could be used without danger of lessening the tracheal lumen. It is possible that had chromic catgut been used at the first operation it would have been successful. Silk was used. Three of the five silk sutures were recovered at the second operation. The symptoms of cardiospasm have disappeared.

It is now one year after operation, and the boy has gained 10 pounds (4.5 Kg.) and grown 2 inches (5 cm.).

NEUROLOGIC COMPLICATIONS OF INFECTIONS OF TEMPORAL BONE AND PARANASAL SINUSES

SUMMARY OF TWENTY YEARS' (1919 TO 1938) EXPERIENCE

JOSEPH C. YASKIN, M.D.
PHILADELPHIA

(Concluded from page 182)

NONSUPPURATIVE ENCEPHALITIS

Oppenheim [39] in 1900 and Voss [40] in 1902 described cases of nonpurulent encephalitis associated with aural infections. They stated the belief that the condition represents a stage in the development of a true abscess but that the encephalitis has failed to progress to suppuration. Borries [41] in 1921 expressed the belief that otogenic encephalitis is a pathologically different process from that form of encephalitis which leads to the formation of abscess. Adson [42] in 1924 described cases in which symptoms and signs of an abscess of the brain were present but on exploration only an accumulation of fluid in the subarachnoid space and congestion of cerebral convolution appeared. He attributed the clinical picture to localized encephalitis and termed it "pseudobrain abscess." Yerger [43] in 1925 and Symonds [44] in 1927 described cases in which evidences of increased intracranial pressure and focal disease of the brain associated with disease of the temporal bone and sinus were presented but no meningitis or abscess appeared on exploration and recovery resulted from the procedures. Similar cases have been reported by Cairns,[45] Key-Aberg,[46] Voss [47] and others.

39. Oppenheim, H.: Zur Encephalitis acuta non purulenta, Berl. klin. Wchnschr. **37**:201, 1900.

40. Voss, F.: Drei Fälle von Encephalitis im Anschluss an Otitis media, Ztschr. f. Ohrenh. **41**:223, 1902.

41. Borries, G. V. T.: Otogenous Encephalitis, Hospitalstid. **64**:545, 1921; Ztschr. f. d. ges. Neurol. u. Psychiat. **70**:93, 1921.

42. Adson, A. W.: Pseudobrain Abscess, S. Clin. North America **4**:503, 1924.

43. Yerger, C. G.: Acute Toxic Meningo-Encephalitis of Otorhinogenic Origin, Arch. Otolaryng. **1**:198 (Feb.) 1925.

44. Symonds, C. P.: Some Points in the Diagnosis and Localization of Brain Abscess, J. Laryng. & Otol. **42**:440, 1927.

45. Cairns, H.: Abscess of the Brain, J. Laryng. & Otol. **45**:385, 1930.

46. Key-Aberg, H.: Contribution à l'étude de l'encéphalite otogène, Acta oto-laryng. **10**:75, 1926.

47. Voss, O.: Otitis media und Encephalitis, Ztschr. f. Hals-, Nasen- u. Ohrenh. **21**:596, 1928.

The review of the literature indicates that nonsuppurative encephalitis of variable severity originating from disease of the temporal bone or sinus gives rise to symptoms of focal disease of the brain, with or without evidences of increased intracranial pressure and with slight fever and pleocytosis in most cases. When localized, nonsuppurative encephalitis may simulate abscess of the brain, from which it can be differentiated only by observation and in some cases only by intracranial exploration. Failure to find suspected abscess on intracranial exploration need not mean that the abscess was missed or that further exploration is indicated, if the patient shows continuous improvement. Early and thorough removal of foci and establishment of drainage are important in all cases. These measures may in some cases lead to recovery and prevent unnecessary intracranial explorations, as is shown by the cases in this series.

In this series there were 5 cases of nonsuppurative encephalitis, 2 of otitic (cases 11 and 12) and 3 of sinal origin (cases 13, 14 and 15), and because of their special interest all cases are abstracted.

OTITIC HYDROCEPHALUS AND ARACHNOIDITIS

Circumscribed serous meningitis, otitic arachnoiditis and pseudobrain abscess or tumor are names given by various writers to a number of unusual neurologic complications of otitis and disease of the paranasal sinus traceable to disturbance of the arachnoid and manifested by increased intracranial pressure, with or without changes in the spinal fluid or signs of focal involvement of the brain, in which the patient usually recovers promptly with the relief of the increased intracranial pressure. Shapiro [48] divided these conditions on pathologic grounds into four groups:

1. A fibrous and adhesive variety. This is common in the anterior but uncommon in the posterior fossa.

2. A cystic form. In this some part of the subarachnoid space, usually one of the cisterns, undergoes mild inflammation, resulting in obstruction of the normal circulation of the cerebrospinal fluid, with formation of a pseudocyst in the affected area. Grossly the arachnoid membrane is thickened and opaque; histologically there is infiltration of round cells in the arachnoid mesh and in some cases sclerotic changes in the underlying cortex. [Davis and Haven [49]].

3. Internal hydrocephalus. This may be due to (*a*) inflammatory closure of one or more of the foramens in the ventricles, the aqueduct of Sylvius or the roof of the fourth ventricle, or (*b*) hypersecretion with so-called mechanical obstruction of the foramens.

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48. Shapiro, S. L.: Otogenic Aspects of Arachnoiditis, Arch. Otolaryng. **28**: 546 (Oct.) 1938.

49. Davis, L., and Haven, H. A.: A Clinicopathologic Study of the Intracranial Arachnoid Membrane, J. Nerv. & Ment. Dis. **73**:129 and 286, 1931.

4. Generalized intracranial hypertension. There is a free flow through the subarachnoid space, but the condition is due to (*a*) hypersecretion or (*b*) obstruction to the normal absorptive channels by inflammation of the arachnoid villi.

Shapiro further suggested:

From a clinical aspect cases of arachnoiditis fall into three groups:

A. Cases in which the history and symptoms suggest a tumor of the brain.

B. Cases in which abscess of the brain appears probable.

C. Cases in which there is a relatively sudden rise of intracranial pressure with severe symptoms but with no focal signs.

All three groups may possess an interest for the otologist, both from an etiologic and from a diagnostic point of view.

In this series there were several cases which fall into this unusual category. Case 16 is an illustrative one of adhesive arachnoiditis with symptoms simulating a tumor of the brain, while in cases 11, 12 and 13 the possibility of abscess of the brain was suggested.

The third type, otitic hydrocephalus, probably deserves most consideration, although it is uncommon and probably not a distinct clinical entity. It is acute or subacute hydrocephalus occurring in association with disease of the temporal bone. The literature on the evolution of the concept of otitic hydrocephalus was fully and critically reviewed by Williams.[50] Symonds,[51] who suggested the name otitic hydrocephalus, stated: "The condition appears almost confined to children and adolescents. It may occur as a complication of an acute or chronic otitis media, with or without . . . meningitis." The pathologic picture of the condition is not known except that there is "either an excessive secretion from the choroid plexus or a defective absorption through the arachnoid villi." Some authors hold that there may be an inflammatory condition of the meninges (Williams [50]).

According to Symonds, "in the fully-developed state . . . intermittent headache and papillœdema are the most constant [symptoms]. A sixth nerve paralysis on the side of the discharging ear has been recorded in a number of cases." The headache may be severe and may be accompanied by nausea or vomiting. The papilledema may be high and may be followed by optic atrophy. Drowsiness is occasionally present, but as a rule the child is clear mentally. The onset "may be insidious, or [symptoms] . . . may develop after a preliminary phase of fever and cervical rigidity."

The cerebrospinal fluid in the fully-developed state is under increased pressure, but clear and contains no excess of cells or protein. In those cases in which there is a preliminary phase of meningitis, the . . . fluid examined at this stage shows

50. Williams, H. L.: Otitic Hydrocephalus, Arch. Otolaryng. **25**:632 (June) 1937.

51. Symonds, C. P.: Otitic Hydrocephalus, Brain **54**:55, 1931.

pleocytosis and an increase in protein. . . . The course of the illness may be protracted to weeks or months, but leads towards complete recovery.

In some cases, however, impairment of vision results from optic atrophy.

In the treatment of otitic hydrocephalus the first requisite is surgical attention to the local disease of the temporal bone, removing foci of infection and establishing good drainage. The next procedure of importance is lumbar puncture, which may be repeated if recurrent headache or persistent papilledema exists. "If repeated lumbar puncture fails to relieve the symptoms, ventricular puncture should be undertaken." If doubt exists regarding the presence of an abscess, an intracranial exploration is indicated.

The differentiation from a cerebral abscess is obviously difficult and often cannot be made without exploration. Symonds stressed that in these cases the constant headache, the signs of focal involvement of the brain and the increase in cells and protein in the spinal fluid, frequently found with abscess of the brain, do not occur.

In this series there were 2 cases of otitic hydrocephalus (cases 17 and 18), which are abstracted.

THROMBOSIS OR PHLEBITIS OF THE INTRACRANIAL VENOUS CHANNELS

Thrombosis or phlebitis of the lateral sinus, the cavernous sinus, the superior longitudinal sinus, the petrosal sinuses or the cerebral or cerebellar veins may be caused by infections of the temporal bone and paranasal sinuses and in turn give rise, by venous obstruction, retrograde extension of infection or venous stasis, to subdural or subarachnoid hemorrhage, subdural, cerebral or cerebellar abscess, encephalitis or meningitis.

Thrombosis of the Lateral Sinus.—Nielsen and Courville,[52] in a study of 15,000 autopsies, found 43 cases of thrombosis of the lateral sinus, in 4 of which the condition was bilateral. In the 43 cases, 15 patients had septic meningitis; 7 had abscess of the brain; 2 had subdural, and 2 extradural, abscesses, and 4 had subdural hemorrhage. Coates, Ersner and Persky [53] reported involvement of the lateral sinus in 14 of 969 cases in which mastoidectomy was performed in eleven years (1.4 per cent). These figures agree with those of many other large series reported. The mortality varies from 14 to 35 per cent with different surgeons. The infection may take place (*a*) by an extravenous route or (*b*) by intravenous extension. Thrombosis of the lateral sinus

52. Nielsen, J. M., and Courville, C. B.: Intracranial Complications of Otogenous Thrombosis of Lateral Sinus, Ann. Otol., Rhin. & Laryng. **46**:13, 1937.

53. Coates, G. M.; Ersner, M. S., and Persky, A. H.: Lateral Sinus Thrombosis with a Review of the Literature, Ann. Otol., Rhin. & Laryng. **43**:419, 1934.

may be (*a*) simultaneous with the otitic infection and mastoiditis, (*b*) postoperative or (*c*) latent in chronic infections.

The symptoms of thrombosis of the lateral sinus include the following types: (1) systemic—elevation in temperature, usually of the steeplechase variety, chills or chilly sensations, parallel acceleration of the pulse, sweats, leukocytosis, gradually developing anemia, a positive blood culture in over 50 per cent of cases and metastatic abscesses; (2) local—tenderness over the jugular vein, slight defensive rigidity of the neck and adenitis; (3) cerebral—headache, evidences of increased intracranial pressure, involvement of the nerves in the posterior fossa, bacterial meningitis, cerebral or cerebellar abscess and Horner's syndrome.

The headache may be due to sepsis, to the local process or to increased intracranial pressure, which is ascribed to the occluding thrombus causing venous damming in the petrosal and cavernous sinuses (Eagleton [54]). The opposite lateral sinus must carry the major outflow from the skull; in the presence of anomalies in size (Ersner and Myers [55]) the opposite sinus may be small and unable to drain the venous system, and marked intracranial pressure may result.

An increase in spinal fluid pressure occurs, often accompanied by an increase in cells.

Choking of the disks may occur. White [56] found papilledema in 33 of 62 cases and Atkins [57] in 17 of 40 cases, and Blau [58] found 17 cases of optic neuritis and 13 cases of choking in 162 cases. The optic swelling disappears with lumbar puncture, dehydration and administration of hypertonic solutions.

The present series comprises 19 cases, in 9 of which evidences of thrombosis of the lateral sinus were present at the time of the first operation (on the right in 6 and on the left in 3) and in 10 of which they developed subsequent to mastoidectomy (on the right in 4 and on the left in 6).

In the 19 cases, 7 patients died, and in all but 1 the condition was accompanied by intracranial complications. In the 7 fatal cases, 3

54. Eagleton, W. P.: Circulatory Disturbances Following Ligation of Internal Jugular Vein, Arch. Otol. & Laryng. **35**:91, 1906.

55. Ersner, M. S., and Myers, D.: An Aid to the Diagnosis of Intracranial Complications Resulting from Venous Circulatory Disturbances of the Temporal Bone, Laryngoscope **43**:800, 1933.

56. White, J. W.: Study of Lateral Sinus Thrombosis, Laryngoscope **36**:96, 1926.

57. Atkins, R. T.: A Report of Forty Cases of Lateral Sinus Thrombosis, Laryngoscope **36**:96, 1926.

58. Blau, cited by Braun, A.: Sinus Thrombophlebitis, New York, Paul B. Hoeber, 1928.

patients had abscess of the brain (1 temporosphenoid and 2 cerebellar), 2 of the abscesses being associated with bacterial meningitis; 1 had meningitis and subdural abscess; 1, meningitis; 1, thrombosis of the superior longitudinal sinus, and 1, septicemia.

In the 19 cases 11 patients had neurologic complications.

Of the 19 cases studies of the eyes were made in 11, in which 4 patients had bilateral papilledema, 2 had unilateral papilledema (1 ipsilateral and the other contralateral), 2 had venous congestion of the fundi and 3 presented normal fundi.

In the 19 cases, 3 patients had abscess of the brain, 1 subdural abscess and 4 bacterial meningitis.

In the 19 cases, 4 patients presented evidences of meningeal irritation accompanied by some evidences of increased intracranial pressure, and all recovered. Of the 4 patients, 3 had choking of the optic disks, and none had pleocytosis of the spinal fluid.

Thrombosis of the Cavernous Sinus.—Courville and Rosenvold [5] tabulated a number of series of cases reported, by ten authors and including their own, and found that the most common causes of thrombosis of the cavernous sinus are, in the order mentioned, (*a*) infections about the face, the eyes, the orbits, the lips and the side of the nose; (*b*) infections of the ear and mastoid; (*c*) sinal and intranasal infections; (*d*) oral and dental infections; (*e*) infections of the throat, and (*f*) infections of the nares.

When associated with disease of the temporal bone, thrombosis of the cavernous sinus is usually secondary to thrombosis of the lateral or the petrosal sinus, to associated disease of the paranasal sinuses, to orbital infection or to unrecognized disease in the opposite temporal bone, as in case 19 of this series.

Thrombosis of the cavernous sinus may follow infection of any of the sinuses, but sphenoiditis is responsible for it in more than half of the cases (Turner and Reynolds [3]). This frequency is ascribed to the direct connections between the veins draining the sphenoid sinus and those draining the cavernous sinus, or the carotid venous plexus. When the thrombosis is secondary to ethmoiditis or frontal sinusitis, it is usually preceded by orbital cellulitis and thrombosis of the ophthalmic and ethmoid veins. When it follows submucous resection or septal abscess, the infection travels by way of the ethmoid or sphenopalatine veins, which drain into the pterygoid plexus and thence into the cavernous sinus. It may follow inflammation of the maxillary sinus, the infection traveling by way of the orbit or the pterygoid plexus. It is occasionally associated with pachymeningitis interna and much more commonly with septic leptomeningitis.

In this series there were 11 cases. In 4 it followed dental extraction; in 3, infections about the face; in 2, sinal infection (in 1 of these it followed removal of a polyp), and in 2, chronic otitis and mastoiditis. In 1 of the last-mentioned cases it was associated with labyrinthitis and an extracerebellar abscess. In 3 cases the patient had frank meningitis and in 1 only meningeal irritation. Only 3 patients in the 11 cases had bilateral involvement. The rest succumbed before the process had a chance to extend to the contralateral side.

The clinical picture in these cases is uniformly terrifying: Evidence of an overwhelming systemic infection and proptosis of first one eye and then the other, accompanied by immobility of the eyeball are followed by evidences of meningitis. Edema of the eyelids and chemosis of the bulbar conjunctiva depend on the origin of the infection.

Thrombosis of the Superior Longitudinal Sinus.—A rare condition, thrombosis of the superior longitudinal sinus is secondary to frontal sinusitis or to disease of the temporal bone, especially thrombosis of the lateral sinus. According to Courville and Rosenvold,[5] Killian [59] stated that there were four possible pathways which might be traversed from the frontal to the superior longitudinal sinus:

> (1) through bone by direct or indirect extension; (2) through the diploic veins, some of which ultimately drain into the superior longitudinal sinus, by infection with osteomyelitis; (3) through vascular connections between the frontal and the superior longitudinal sinus, and (4) through communication between the veins of the galea (infected by osteomyelitis) and the superior longitudinal sinus, by way of the parietal emissary vein.

It is said to occur most commonly in children suffering from malnutrition, anemia and dehydration.

Thrombosis of the superior longitudinal sinus is associated with thrombosis of the superior cerebral veins, extradural and subdural abscess, intracerebral abscess and septic leptomeningitis.

The clinical manifestations of thrombosis of the superior longitudinal sinus are vague. The clinical picture is often masked by the symptoms of the primary diseases and by thrombosis of the lateral sinus. The syndrome which was considered characteristic of the occlusion of the superior longitudinal sinus, i. e., alternating jacksonian convulsions, ending in hemiplegia, was shown by Nielsen and Courville [52] to occur as frequently in thrombosis of the lateral sinus. Fatal termination is the rule.

In this series there were 4 cases, 3 of children. In 1 case the thrombosis was associated with thrombosis of the lateral sinus, in another with bronchopneumonia and in 2 with disease of the frontal sinus and extradural abscess. In all there were convulsions and hemiplegia.

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59. Killian, G.: Die Thrombophlebitis des oberen Langsblutleiters nach Entzündung der Stirnhöhlenschleimhaut, Ztschr. f. Ohrenh. **37**:343, 1900.

CRANIAL NERVES

It seemed useless to study the diseases of the olfactory nerve among neurologic conditions associated with disorders of the temporal bone and paranasal sinuses. Retrobulbar neuritis, lasting painful conditions associated with sinal disease and repeated operations and Ménière's syndrome will be presented in a later contribution. The simultaneous involvement of the ninth, tenth and eleventh cranial nerves in the region of the jugular foramen or isolated involvement of the last four nerves was not encountered in this series. The discussion will therefore be limited to the optic nerve, the nerves supplying the extraocular muscles, the trifacial and the facial nerve.

Optic Nerve.—Retrobulbar and optic neuritis caused by sinal disease will be presented in a later publication. Papilledema ranging from slight congestion to several diopters of choking was found in this series in association with abscess of the temporal lobe in 8 cases, with abscess of the frontal lobe in 9 cases, with cerebellar abscess in 4 cases, with subdural abscess in 3 cases, with extradural abscess in 1 case, with arachnoiditis in 1 case, with otitic hydrocephalus in 2 cases, with nonsuppurative encephalitis in 3 cases and with thrombophlebitis of the lateral sinus in 8 cases.

The visual acuity in these cases differed with the degree of papilledema. Contralateral hemianopic defects were observed in 11 cases of abscess of the temporal lobe. In all other cases of papilledema the visual fields either were normal or showed a general contraction.

Nerves to the Extraocular Muscles.—In all cases of thrombosis of the cavernous sinus there was complete implication of all the cranio-ocular nerves on one or both sides. This series has no instances of isolated implication of the trochlear nerve.

Oculomotor Nerve.—Paralysis of the oculomotor nerve due to sinal disease has been dealt with in another publication (Yaskin [60]), in which the interesting anatomic and pathologic factors responsible for the occurrence of this condition were discussed and 2 cases reported. In the present series varying degrees of oculomotor paralysis were found, in association with extradural abscess in 2 cases and with localized nonsuppurative encephalitis in 1 case.

Abducens Nerve.—Involvement of the abducens nerve is rare in the course of disease of the paranasal sinuses, but it does occur alone or in combination with involvement of the oculomotor nerve (Yaskin [60]). In this series it occurred in 1 case of nonsuppurative encephalitis, in 4

60. Yaskin, J. C.: Paralysis of the Extraocular Muscles: Clinicoanatomic Considerations; Report of Cases of Paralysis of the Oculomotor and Abducens Nerves Due to Unusual Causes, Arch. Ophth. **21**:1010 (June) 1939.

cases of abscess of the frontal lobe and in 1 case of subdural abscess (case 15). Paralysis of the abducens nerve is common in the course of disease of the temporal bone. It may occur (*a*) as evidence of increased intracranial pressure, (*b*) as a part of the Gradenigo syndrome, (*c*) as a symptom of apical petrositis (Yaskin and Kornblum [61]) or (*d*) in diffuse bacterial meningitis.

(*a*) As evidence of increased intracranial pressure paralysis of the sixth nerve is a late symptom and usually occurs in severe conditions. In this series it occurred in association with extradural abscess in 1 case (case 8), with abscess of the temporal lobe in 4 cases and with abscess of the frontal lobe in 4 cases.

(*b*) The Gradenigo syndrome consists of aural discharge with homolateral pain in the face and paralysis of the abducens nerve. It is due to localized meningitis in the region of the petrous apex associated with edema and pressure in Dorello's canal and was at one time regarded as a benign process, terminating in spontaneous recovery. In recent years, however, the recognition of the entity apical petrositis, which closely resembles the Gradenigo syndrome, renders the prognosis in cases of Gradenigo syndrome more guarded. In this series there were 5 cases of Gradenigo syndrome, in all of which it followed simple mastoidectomy, and all the patients recovered without subsequent operations.

(*c*) Apical petrositis was discussed in a previous publication (Yaskin and Kornblum [61]). Since that publication there has been only 1 additional, fatal, case, making a total of 8 cases, with paralysis of the abducens nerve due to apical petrositis in 3 cases.

(*d*) No reliable figures can be given regarding the frequency of occurrence of paralysis of the sixth nerve in the cases of bacterial meningitis in this series.

Trigeminal Nerve.—The facial pain associated with chronic sinal disease, with Sluder's neuralgia and pain in the vidian nerve, and the psychalgias will be a subject of a later publication. Pain of one or more branches of the fifth nerve was found in the 5 cases of Gradenigo's syndrome, in all 8 cases of petrositis and in association with extradural or subdural abscess in most cases and with abscess of the temporal lobe in 2 cases.

Facial Nerve.—The facial nerve is frequently implicated in the course of disease in either the petrous or the mastoid portion of the temporal bone. The paralysis may be complete or incomplete. It may occur preoperatively, may be produced at operation and observed during the

61. Yaskin, J. C., and Kornblum, K.: Neurologic Aspects of Petrositis, Arch. Neurol. & Psychiat. **37**:307 (Feb.) 1937.

operation or immediately thereafter or may appear sometime after the operation. According to Kerrison,[12] preoperative paralysis of the facial nerve

> may result from any of the following conditions: (1) Acute suppurative otitis media of severe type, the inflammatory process extending through the tympanic wall of the Fallopian canal, and the nerve being either directly involved or subjected to pressure by inflammatory products within the canal. This is commoner in young children than in adults. (2) During acute suppurative otitis media as a result of direct exposure of the nerve through a defect in the tympanic wall of the facial canal. (3) In chronic suppurative otitis media, the necrotic process involving the facial canal. (4) In suppurative labyrinthitis secondary to chronic middle-ear suppuration, a necrotic tract through the horizontal semicircular canal may by downward extension involve the facial. (5) Facial paralysis is an occasional accompaniment of otitic meningitis, in which case the nerve lesion is probably more often the result of an intermediate infection of the labyrinth than of an extension of inflammation from the meninges to the nerve-trunk as it traverses the internal auditory canal. (6) Tuberculous lesions. In a very large percentage of cases of middle-ear tuberculosis, the facial nerve is involved. A tubercular element in the pathogenesis of facial paralysis is recognized as affecting the prognosis unfavorably, from the greater frequency with which the nerve is actually destroyed. (7) Herpes zoster auriculæ (Hunt) is an occasional cause of facial paralysis. In this affection the morbid changes in the nerve are clearly an extension of the inflammatory process primarily affecting the geniculate ganglion.
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> Generally speaking, facial paralysis resulting directly from middle-ear or mastoid suppuration—the labyrinth having escaped infection—offers, under prompt and rational treatment, a perfectly favorable prognosis. Usually all that is required to effect a cure is careful removal of all diseased bone through a simple mastoidectomy or radical operation, according to the nature of the tympanic lesion.
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> **Postoperative facial paralysis** may occur: (a) as the immediate result of division or injury of the nerve during a radical operation; or (b) as the deferred result of a slight traumatism, the paralysis appearing only after an interval of several hours or days has elapsed. (c) When the tympanic wall of the facial canal is either defective or unusually thin, paralysis may result directly from the pressure of a gauze dressing packed too tightly into the wound cavity. (d) A thick-walled, sclerotic mastoid with a very small, deeply-placed antrum is a type of bone in which during a simple mastoidectomy great care may be necessary to avoid injury to the nerve.

In this series there were 42 cases, some of which have already been reported by Persky.[62] Of these the paralysis developed preoperatively in 24 and postoperatively in 18.

In the 24 cases in which palsy of the facial nerve developed prior to operation, the age incidence was from 6 years to 72, with an average of 39. There were 10 males and 14 females. In 13 cases the palsy was on the left side and in 11 on the right. In 14 cases it followed chronic infection of the ear; in 11, acute infection. The sense of taste was

62. Persky, A. H.: Facial Palsy of Otitic Origin, Arch. Otolaryng. **27**:395 (April) 1938.

recorded as tested in 12 cases. In these, 11 patients showed a loss of the sense of taste in the anterior two thirds of the ipsilateral half of the tongue, while in 1 the sense of taste was unimpaired. In the 24 cases 19 patients had operations: 7 had simple and 11 radical mastoidectomy and 1 only myringotomy. Five of the patients operated on showed cholesteatoma, and the rest showed acute or chronic mastoiditis. One of the patients operated on died of meningitis; 8 improved, and 10 showed no improvement. In 1 of the patients who did not improve labyrinthitis developed. Five patients were not operated on. Of these 4 showed some improvement and 1 is recorded as unimproved.

In 18 cases peripheral palsy of the facial nerve developed after an operation. The age incidence varied from 5 years to 58, with an average of 27. There were 7 males and 11 females. In 8 cases the palsy was on the left side and in 10 on the right. The sense of taste was tested in 9 of the 18 cases and was found to be lost in the ipsilateral anterior two thirds of the tongue in all 9. In 1 case, palsy followed immediately after myringotomy for acute otitis media, and the patient showed no improvement with subsequent treatment. In 4, it followed immediately after simple mastoidectomy for acute mastoiditis, and 3 of the patients showed no improvement, while 1 is considerably improved but has been receiving electrical treatment for the last ten years. Thirteen patients were operated on because of chronic infection, with or without acute exacerbation. All but 1 of these were subjected to radical mastoidectomy. Eleven of the 13 patients showed immediate paralysis, while in 2 paralysis developed within forty-eight hours after operation. Two of the 13 patients presented cholesteatoma at operation; 1 had labyrinthitis prior to operation; in 3 labyrinthitis developed after operation; in 1 an abscess of the temporal lobe developed; and in 2 encephalitis developed. Of the 13 patients, 1 died of an abscess of the temporal lobe, and the rest showed no substantial improvement.

On the basis of this study, I believe that when peripheral palsy of the facial nerve occurs in association with disease of the temporal bone an exploratory operation is indicated, unless it can be shown that the palsy is due solely to causes outside of the temporal bone. The advisability of a secondary operation in cases in which palsy of the facial nerve follows an operation must be determined by the otorhinologist from his previous operative findings and the subsequent surgical developments.

Hunt's Syndrome: In this series there were 2 cases of Hunt's syndrome involving the facial nerve and presenting herpes on the soft palate, in the external auditory canal and over the auricle (Hunt [63]).

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63. Hunt, J. R.: Geniculate Neuralgia (Neuralgia of the Nevus Facialis): Further Contribution to the Sensory System of the Facial Nerve and Its Neuralgic Conditions, Arch. Neurol. & Psychiat. **37**:253 (Feb.) 1937.

SUMMARY AND CONCLUSIONS

This presentation contains a review of 326 cases in which neurologic complications arose from infections of the temporal bone and paranasal sinuses. Of these, the complications were associated with disease of the temporal bone in 235 and with infection of the paranasal sinuses in 91. The 326 cases are classified and discussed from the standpoint of pathways of infection, clinical manifestations, diagnosis and treatment. Nineteen cases of special interest are reported in abstract form.

On the basis of a study of this material and some review of the literature, the following conclusions appear pertinent:

1. For a full appreciation of the neurologic complications arising from disease of the temporal bone and paranasal sinuses the neurologist, if he wishes to be of aid to the otorhinologist, must be conversant with the intricate anatomy of these structures and with its variations and anomalies. The temporal bone is no more a unitary structure than the brain is an equipotential organ. The neurologist, moreover, must be familiar with the various pathways of infection leading to the neurologic complications.

2. It is important to remember that there may exist multiple etiologic factors, such as polysinusitis and simultaneous infection of the temporal bone and paranasal sinuses. The neurologic complications may arise on the side contralateral to the infected paranasal sinus. They may first become manifest after the infection of the temporal bone and paranasal sinuses disappears, and, on the other hand, they may be present with "primary" mastoiditis, i. e., with an intact tympanic membrane or in the absence of any recent aural discharge.

3. For full orientation the clinician must bear in mind that the neurologic complications may arise from disease within the bone, as in peripheral palsy of the facial nerve or that the clinical manifestations may be due to processes in one or more of the following locations: the dura, the extradural and subdural spaces, the leptomeninges, the brain substance and the various intracranial venous channels. On the other hand, it is important to remember that infections in the temporal bone and paranasal sinuses may coexist with neurologic conditions resembling complications of otorhinogenic origin but due to causes entirely unrelated to these infections. Worthy of mentioning are meningococcic and tuberculous meningitis, meningeal irritations due to causes other than known bacteria, spontaneous subarachnoid hemorrhage, chronic subdural hematoma, tumor of the brain and visceral infections.

4. For accurate diagnosis, the neurologist not only must make repeated complete neurologic examinations but also must always take

into account a number of factors. To start with, he must ascertain whether the process is acute, chronic or chronic with acute exacerbation. In addition to evaluating the symptoms and signs in their chronologic development, he must take into account the previous operative findings, the systemic reactions and the bacteriologic and other laboratory observations. Moreover, in formulating a diagnosis it is important to remember that, unlike many other neurologic conditions, these complications often run a rapid and changeable course.

5. Accurate anatomic diagnosis of neurologic complications arising from infection of the temporal bone or paranasal sinuses is difficult in a great many cases. The diagnosis of some conditions, such as extradural and subdural abscess, can be established only by exploration. The diagnosis of some neurologic complications, such as *early* meningitis, abscess of the brain and petrositis, is difficult because of the vagueness of the findings. In other cases the diagnosis is uncertain because of the difficulty in interpreting the existing symptoms and signs, which may be indicative of several different conditions. Thus, increased intracranial pressure as manifested by papilledema and increased intraspinal pressure may be due not only to abscess of the brain or severe meningitis but also to the more benign otitic hydrocephalus, arachnoiditis or nonsuppurative encephalitis. The same difficulty applies to the interpretation of some focal signs of disease of the brain. Thus, central palsy of the facial nerve, hemiparesis and even aphasia are encountered in such diverse conditions as abscess of the brain, extradural abscess and nonsuppurative encephalitis.

6. In making a diagnosis it is important to determine whether the complications in the cranial nerves are purely local, like the palsy of the abducens nerve of a Gradenigo syndrome, or a manifestation of a major intracranial complication, like the same palsy in the course of petrositis, abscess of the brain or beginning bacterial meningitis.

7. In the matter of treatment the neurologist has the responsibility of advising the removal of foci and the establishing of drainage, counseling lumbar puncture and other diagnostic procedures and suggesting chemotherapy and intracranial exploration.

8. The management of the neurologic complications of otorhinogenic origin requires the close cooperation of the otorhinologist, the ophthalmologist and the neurologist. The otorhinologist should consult with the ophthalmologist and the neurologist as soon as neurologic complications are suspected. Early and more accurate diagnosis will insure more effective treatment.

APPENDIX

REPORT OF NINETEEN CASES

CASE 1 (W. T.).—*Abscess of the right frontal lobe, first manifesting itself after recovery from sinusitis; ventriculogram, drainage and recovery.*

In an 11 year old white boy, whose family history and past medical history were noncontributory, frontal headache and fever, with the temperature as high as 101 F., developed during the third week in June 1938. A diagnosis of acute sinusitis was made, and in a few days infraorbital and paranasal swelling and erythema developed on the right. On July 3, after an elevation of temperature to 103 F., the patient had a generalized tonic convulsion lasting ten minutes. Study in another hospital revealed no significant findings, and he was discharged after one week, in good condition. On July 11 headache and vomiting developed, necessitating readmission, at which time ophthalmoscopic examination revealed bilateral choking of the disks. The patient was transferred to the Graduate Hospital on July 25 with a subjective complaint that headache, vertigo and vomiting occurred when he was in the erect posture.

Objectively, on admission, the boy was found to be rather alert mentally There was persistent bradycardia, the pulse rate ranging between 60 and 70 beats per minute. The temperature fluctuated between 98.4 and 100 F. The blood pressure was 94 systolic and 68 diastolic. The eyes presented bilateral catarrhal conjunctivitis; both nerve heads were swollen to 6 D. with petechial hemorrhages; visual acuity was 6/6 bilaterally, and the visual fields were normal. Bárány examination suggested a supratentorial intracranial lesion on the right. There was no clinical evidence of either acute or chronic sinal disease. Roentgen examination of the skull on July 26 gave negative results, as did an examination of the paranasal sinuses. It was not until the films were reexamined at a time when a neurologic diagnosis had been established that the roentgenologist noted considerable haziness in the outline of the right frontal sinus, associated with thickening of the mucous membrane. These changes were thought indicative of inflammation of the right frontal sinus in which an infection had probably broken through the roof of the sinus. Early osteomyelitis could not be excluded.

The clinical impression of the staff was that of an expanding intracranial lesion, most likely a tumor, although one observer adhered to a diagnosis of abscess of the brain.

On September 1 a ventriculogram revealed "the presence of a large space-taking lesion in the right frontoparietal region, causing displacement of the ventricular structures of the left side and incomplete filling of the right anterior horn of the lateral ventricle." On the basis of such findings frontoparietal craniotomy was performed on the right with the patient under anesthesia induced by avertin with amylene hydrate. Because of suggested abscess of the brain, the dura was nicked, and the operative site was explored before wide exposure was attempted. A mass was felt 3.5 cm. below the surface of the posterior portion of the right frontal lobe. Aspiration revealed yellow material suggestive of fluid from a tumor in Rathke's pouch. The dura was opened, the lesion outlined and a block of cortex 2 inches (5 cm.) square removed from the top of the tumor. Reaspiration revealed 1 cc. of thick pus, which on examination was found to contain gram-positive cocci.

The abscess defied enucleation because of (1) its thin capsule and (2) its firm attachment in the direction of the pituitary fossa. The dura over the lesion was

excised, and the edges overlying the lesion were sutured in position. A section of bone was removed and the bone flap wired in position. The abscess was packed with iodoform gauze and drained through a stab wound in the scalp. Three days postoperatively the abscess was opened and drained. It was removed in its entirety on the eighth postoperative day. Bacteriologic examination revealed hemolytic Staphylococcus aureus in pure culture. A pathologic report on the capsule stated: "The brain tissue bordering on the abscess is loose and more or less disintegrated. The cells are chiefly glial cells, lymph and plasma cells, with a collar of lymphoid cells about the capillaries. There are few polymorphonuclears. Elsewhere the brain is not so much involved. An area of hemorrhage is present."

Convalescence was, unfortunately, delayed because a small sponge had been left in the wound, which continued to drain cerebrospinal fluid. Reexamination of the eyegrounds on September 23 showed the bilateral papilledema diminished to 4 D., with visual acuity of 6/6 and normal fields. The patient was discharged to the family physician on September 8, with a well epithelializing wound, not completely closed but still draining small amounts of purulent material.

After his discharge from the hospital two draining sinuses appeared in the line of incision, and the patient was readmitted on November 7. A roentgenogram of the skull, November 8, disclosed "mottling along the superior margin of the flap of the right frontoparietal bone indicative of osteomyelitis."

On November 8, the scalp flap was reopened and the bone removed. Osteomyelitis was found to involve the medial border of flap just lateral to the longitudinal sinus. As the flap was removed, a previous opening into the ventricle was reestablished. This was covered with an alcohol sponge, from which ligatures were brought through the previous drainage opening. The patient's convalescence has been uneventful except for continued drainage from a slowly healing incision.

Comment.—This case is important from several standpoints. Unlike others with abscess of the brain, the patient was mentally alert, presented an extreme degree of papilledema and appeared more like a patient with a rapidly expanding tumor of the posterior fossa of childhood without cerebellar signs than one with an abscess of the frontal lobe. The absence of any clinical or roentgen evidence of sinusitis would tend to strengthen the diagnosis of a tumor. However, the history of antecedent sinal disease and the Bárány findings led to ventricular studies and cautious exploration for an abscess.

CASE 2 (A. S.).—*Fatal bacterial meningitis secondary to mastoiditis without aural discharge; history of an old aural infection.*

In a boy 11 years of age, with an irrelevant family history and past medical history, vomiting with some abdominal pain developed in the early part of June 1930. At operation, a normal appendix and no cause for the vomiting were found. He was readmitted to the hospital on June 23, complaining of headache and vomiting. The temperature and pulse were normal. At this time a history was obtained of a discharge from the right ear some years previously. Examination revealed an old perforation of the right ear drum but no discharge. There was little tenderness over the mastoid, but roentgen examination revealed acute mastoiditis on the right side. In addition the patient showed bilateral choking of the optic disks. On June 27 he exhibited apathy, ptosis of the right upper eyelid, a rise in temperature, bradycardia and marked meningeal irritation. On June 27 a

simple mastoidectomy was done on the right side, which revealed acute mastoiditis. On June 29 he became stuporous and showed evidence of meningitis, a slow pulse and increased spinal fluid pressure, with 390 leukocytes. He succumbed to purulent meningitis on July 5.

Comment.—This case illustrates the necessity of investigating the temporal bone in infectious processes of the nervous system of obscure causation. It is well known that intracranial infection may follow lesions of the middle ear without perforation of the drum and without mastoiditis.[10] This case also calls attention to the significance of causeless vomiting, especially in childhood.

CASE 3 (K. G.).—*Spontaneous subarachnoid hemorrhage first diagnosed as meningitis because of coexisting sinusitis; recovery.*

A 42 year old white married woman gave a past medical history which was irrelevant except that for two years she had had severe headaches, for which she had taken a variety of headache preparations. About two weeks prior to her admission to the Graduate Hospital, on April 23, 1935, she was taken with a queer feeling across the forehead, became dizzy and vomited, and immediately thereafter severe headache developed. For the following few days the pain was unbearable. She was treated for grip and sinusitis until admission to the hospital. When first seen, on April 26, she complained of a left-sided headache and pain in the back of her head. On the morning of April 26 she is said to have had a left-sided convulsive seizure.

Objective examination was reported as follows: The pulse, temperature and blood pressure were normal. The patient was dull and apathetic and complained of frontal and occipital headache, more marked on the left side. When she was aroused her mentality was clear but slow. She had photophobia, hyperesthesia, nuchal rigidity and bilateral Kernig and Brudzinski signs. She had definite weakness of the left external and the left superior rectus muscle, questionable weakness of the lower part of the right side of the face and marked exaggeration of tendon reflexes on both sides, with a right-sided Hoffmann and a left-sided Babinski sign and bilateral clonus with preservation of the abdominal reflexes. Sensation, as nearly as could be determined, was normal. The finger to nose test was carried out accurately, and the heel to knee test was not attempted. There was no astereognosis. The roentgenogram of the skull was normal. There was clinical and roentgen evidence of bilateral ethmoiditis. Routine studies of the urine and the blood gave negative results.

Lumbar puncture revealed high pressure and frankly bloody fluid. Special studies of the blood failed to disclose any dyscrasia.

The diagnosis of spontaneous subarachnoid hemorrhage was made. From then on treatment consisted of repeated lumbar punctures and the free use of codeine and acetylsalicylic acid for the relief of pain. The punctures gave marked relief. The spinal fluid continued to be bloody for about ten days; then it became yellow, and finally, almost clear. At the end of two weeks from the date of admission to the hospital there was little rigidity of the neck and slight manifestation of Kernig's sign. About May 7 paralysis of the right third nerve appeared, with ptosis and inability to move the eye inward, upward or downward. This persisted up to the discharge from the hospital, on May 22. In the succeeding few months the ocular palsy disappeared and the patient made a complete recovery. She still has occasional headaches.

Comment.—With the history of sinal disease and the clinical symptoms that the patient presented, it seemed justifiable for the rhinologist to believe that this was a case of meningitis of sinal origin. It is probable that insufficient attention had been paid to the mode of onset of the acute symptoms and the presence of marked meningeal irritation with so little systemic reaction. This case emphasizes the value of spinal tapping in all cases of doubtful meningeal irritation.

CASE 4 (C. H.).—*Chronic subdural hematoma first diagnosed as abscess of the brain because of a history of sinusitis; operation and recovery.*

A woman aged 21 was admitted to the Graduate Hospital on Aug. 26, 1938. The history was procured from the mother, as the patient was too dull mentally to cooperate. Except that she had had influenza in 1918, the past medical history was noncontributory. She had been married at the age of 18, separated for a year and divorced one year previously. For the past year she had been losing considerable weight. About three weeks prior to admission she had complained of pain in the left shoulder, which she attributed to a draft. The pain in the shoulder improved, but she felt indisposed until about ten days prior to admission, when she began to complain of pain in the left temple, left eye and left side of the face. A day or two later she noticed drooping of the left upper eyelid. The pain became more pronounced, and in addition she had nausea and vomiting. She was admitted to a hospital in one of the neighboring towns and was treated for sinal disease without any improvement. There was a history of chronic nasal discharge, but there had been no acute exacerbation of the nasal infection.

Objective examination on admission was summarized as follows: The pulse rate was 84; the temperature, normal. The patient was dull mentally. She had a tendency to fall asleep in the middle of a sentence. She responded sluggishly to questions and commands, perhaps because of medication. There was practically no rigidity of the neck and only a slight Kernig sign. There was questionable protrusion of the left eyeball. There was some tenderness to percussion of the skull, more marked on the left than on the right. In the course of the examination the patient was observed in attacks during which she complained of severe pain in the left temporal region and face. The fundi showed blurring of the nasal margins, more marked on the left than on the right. There was drooping of the left eyelid. The pupils were dilated, probably by a mydriatic. There was questionable weakness of the lower part of the right side of the face. Otherwise all the cranial nerves were essentially normal. The abdominal reflexes were not obtained. There was weakness of the right arm and leg but also some weakness of the left arm and leg. The entire musculature was flaccid. The tendon reflexes were depressed, more so on the right than on the left, and no Hoffmann or Babinski sign was manifested on either side. No neural tenderness was noted. No definite objective loss of sensation other than that which might be due to sluggish mentality was observed. The finger to nose and the heel to knee test were carried out poorly on the right side because of weakness.

Roentgen examination of the skull was difficult because the patient did not cooperate, but no gross abnormalities were noted. Examination showed mucosal thickening of the left maxillary and both ethmoid sinuses. The frontal sinuses appeared normal, and the sphenoid could not be visualized. Clinical examination revealed no evidence of active sinusitis. The Bárány tests gave entirely negative results. Special studies of the eyes showed definite bilateral papilledema without

any significant changes in the visual fields. Routine studies of the blood and urine gave negative results. Spinal tapping was not attempted, because it had been performed in the hospital from which she was transferred. At that time the spinal fluid pressure, 350 mm. of water, and the composition of the fluid showed no significant abnormality.

In the succeeding few days the patient's mentality and the power in the right arm and leg improved. However, the papilledema was getting greater, although the headache was diminishing. Accordingly, after a ventriculogram had been made, which showed the presence of a massive lesion in the left parietal region, craniotomy was performed; a chronic subdural hematoma was evacuated, and the patient made a satisfactory recovery. She was discharged on October 3.

When she recovered she gave a history to the effect that about four weeks prior to the onset of the headache she had received a beating from her former husband but had not considered it significant and had forgotten all about it before she became mentally dull.

Comment.—The patient was sent in with a diagnosis of abscess of the brain due to sinal disease. Clinically she exhibited signs of an abscess of the brain. However, it is well known that intracranial space-taking lesions, such as tumors or abscesses, may be simulated by chronic subdural hematoma. The latter condition is common, occurring as often without a history of cranial trauma as with such a history.

CASE 5. (R. B.).—*Craniopharyngioma associated with optic atrophy and severe sinusitis; operation on multiple sinuses; craniotomy; patient alive and blind.*

A 30 year old laborer, with a noncontributory family history and past medical history, was admitted to the Graduate Hospital on Dec. 23, 1930, complaining of a throbbing frontal headache, loss of vision in the left eye and progressive loss of weight since August 1930.

Objective examination disclosed bilateral primary optic atrophy and bilateral inflammation of the ethmoid and sphenoid sinuses. In January 1931 submucous resection and bilateral sphenoethmoidectomy disclosed greenish foul-smelling pus. The patient made a good surgical recovery but continued to have his symptoms. In the succeeding two years he continued to have the headache and became totally blind; marked hypopituitary changes developed, but no constant neurologic or roentgen abnormality appeared. The Bárány tests repeatedly gave negative results. An encephalogram made on February 14 was normal.

The patient was next admitted to the Philadelphia General Hospital on July 26, 1932, when roentgen studies disclosed some deformation of the sella turcica, from which no definite conclusion could be drawn. An operation on the right side of the frontal bone on October 10 disclosed a suprasellar cystic tumor, part of which was extirpated. The patient made a good surgical recovery. He is still alive, but totally blind, and shows evidences of marked hypopituitarism. The pathologic diagnosis of the removed specimen was craniopharyngioma.

Comment.—In this case a slowly expanding intracranial tumor was masked by the symptoms of associated sinal disease. It is not at all unusual to encounter cases of visual disturbances due to pituitary or suprasellar tumor in which the patient is treated for sinal disease.

CASE 6 (W. B.).—*Chronic otitis; labyrinthitis followed by thrombosis of the lateral sinus, subdural abscess in the posterior fossa and basal meningitis.*

A dairyman, 51 years of age, was admitted to the Graduate Hospital on Sept. 24, 1937. The family history was irrelevant. About Jan. 1, 1936, the patient had been in an accident which rendered him unconscious for several hours, but he made a good recovery and was in good health until March 1937, when a discharge from the right ear, headache, dizziness and vomiting developed. He improved, but on August 25 he had a severe spell of vertigo with vomiting.

On admission to the hospital, on September 24, he complained of headache of several months' duration and of attacks of vertigo and vomiting by reason of which he had had to discontinue work six or seven weeks before. He stated that his headache was both occipital and frontal and that it was fairly constant.

The objective examination on admission disclosed the following facts: The patient was cooperative but was mentally dull. He was keenest when he complained about his headache. He had a slight elevation of temperature and a definitely slow pulse rate, about 60 per minute. There was slight rigidity of the neck but no Kernig sign. There was definite tenderness to percussion over the right frontotemporal region. The veins over this area were more distended than those on the left. The fundi showed blurring of the disks unaccompanied by any definite changes of the blood vessel ratio. The right palpebral fissure was definitely narrower than the left; the pupils were equal and responsive to light and accommodation. All extraocular movements were full; no nystagmus was observed. The fifth nerve was normal. There was suggestive central palsy of the left facial nerve on both volitional and emotional innervation. There was probably some impairment of hearing on the right. All the other cranial nerves were normal. The abdominal reflexes were not obtained. Station and gait were not tested. The patient had generalized weakness but no localized loss of motor function in any of the extremities. All tendon reflexes were symmetrically diminished, those of the knee and achilles tendon more so than those of the biceps and triceps. There was a definite Babinski reflex on the left side. All forms of sensation, including stereognosis, were accurately evaluated. The heel to knee tests were carried out accurately, as was also the finger to nose test on the left. The finger to nose test on the right was carried out inaccurately, while the pronation and supination test was carried out rather well on both sides.

The course in the hospital was as follows: From the outset the patient had a slow pulse and only a slight rise in temperature. A lumbar puncture on September 26 revealed a pressure of 150 mm. of water and 197 cells, with 43 polymorphonuclears; the leukocyte count was 11,200, with 67 per cent polymorphonuclears. The other laboratory studies gave negative results. Roentgen examination of the sinuses revealed haziness in both frontal and both ethmoid sinuses; that of the right mastoid indicated an infection in early infancy but no active disease; that of the skull gave negative results and that of the chest showed an old inactive tuberculous lesion in the apex of the left lung.

On September 28 radical mastoidectomy was performed on the right side. The lateral sinuses and the posterior fossa were exposed without finding any evidence of an active pathologic process. Puncture on October 8 showed a pressure of 310 mm. of water. On the same day trephination above the right squamous region disclosed no evidence of an abscess of the middle fossa. A second trephination, over the right cerebellar hemisphere, revealed a subdural abscess. The patient died on October 12. The autopsy showed a subdural abscess of the posterior fossa, basal meningitis and thrombosis and suppuration of the lateral sinus.

Comment.—In this case not sufficient attention had been paid to the history of labyrinthine symptoms, and consequently the operative exploration was not sufficiently concentrated on the posterior fossa early in the process. Probably an early and complete exploration of the lateral sinus and the posterior fossa might have altered the course.

CASE 7. (P. S.).—*Severe delirium associated with and following severe sinusitis; subacute pulmonary and multiple renal abscesses revealed at autopsy.*

A 58 year old salesman, with an irrelevant family history and past medical history, was admitted to the Graduate Hospital on Aug. 8, 1938, with his chief complaints loss of weight, headache and a profuse nasal discharge. His difficulties had begun about ten weeks previously, with rhinitis, which became purulent and was diagnosed as malignant disease of the sinuses.

On admission to the hospital his condition was toxic, and he had an elevation of temperature and pulse rate and low grade bilateral polysinusitis. A biopsy, however, revealed only inflammatory tissue and no malignancy.

In spite of local treatment, the patient continued to be in a toxic state, febrile and delirious. After preliminary transfusions the middle turbinate bone was removed, and good drainage was established for all the sinuses. Within two weeks after this procedure the nasal discharge stopped and the temperature returned to normal, but the patient remained somewhat delirious. At this time and for the succeeding ten days repeated physical and neurologic examinations gave entirely negative results. In spite of this he began to have a marked septic temperature without chills, progressive loss of weight and progressively more marked delirium. Repeated blood counts showed only moderate leukocytosis and secondary anemia. Chemical studies of the blood, as well as repeated urinalyses, gave negative results. On September 24 roentgen examination of the chest showed a lesion suggestive of a pulmonary tumor or abscess. On physical examination this lesion appeared to be inactive. A lumbar puncture on the same date showed no increase in pressure and no abnormality of the fluid.

The patient died on October 1. The autopsy of the skull, including the temporal bone, the sinuses and the intracranial contents, showed no abnormality. There was a subacute abscess in the middle lobe of the right lung. There were numerous small abscesses in the substance of both kidneys. These abscesses did not communicate with the renal pelvis.

Comment.—In this case it was difficult to convince ourselves that the delirium was not due to some obscure intracranial complication of sinal origin. It is of rare interest that there was so little laboratory evidence of such extensive pathologic change in the kidneys, which was responsible for death.

CASE 8 (J. C. T.).—*Extradural abscess associated with papilledema, oculomotor involvement and implication of the abducens nerve; acute mastoiditis; operation and recovery.*

A 25 year old farmer was admitted to the Graduate Hospital on July 11, 1929, with the chief complaint recurrent headaches. The family history and past medical history were irrelevant. Following an infection of the upper part of the respiratory tract in January 1929 a discharge had developed in the left ear, and in February he had transient pain in the right ear. The left ear had been

discharging since January. On July 1 pain had suddenly developed in the right temporal region and the right eye and had remained constant and severe. Since July 5 the patient had had diplopia.

Objective examination on admission disclosed a normal temperature and pulse, a discharge from the left ear, some tenderness over the right mastoid, bilateral papilledema (right, 3½ D.; left, 2½ D.), normal visual fields, slight ptosis of the right upper eyelid, weakness of both external recti, more marked on the right, and tremors of the fingers when extended. Roentgen findings were subacute purulent mastoiditis on the left, acute purulent mastoiditis on the right and clouding of the right frontal and both anterior ethmoid sinuses and of the right maxillary antrum. Routine laboratory studies gave negative results.

On July 15, radical mastoidectomy was performed on the right. The exploration disclosed acute mastoiditis, with an extradural and perisinal abscess and a thickened nonpulsating dura. From then on the headache disappeared; the choking of the optic disks and the other neurologic abnormalities gradually receded, and the patient was discharged on August 4 in good condition. He has since remained well.

Comment.—In this case evidences of increased intracranial pressure due to an extradural abscess were presented. In some respects the clinical picture resembled that of otitic hydrocephalus (to be described later), which however usually *follows* mastoidectomy and is unassociated with an active infected focus requiring surgical eradication.

CASE 9 (B. S.).—*Chronic otitis with acute exacerbation; mastoidectomy followed by peripheral palsy of the facial nerve and severe protective meningitis; reoperation and findings of dural fistula; use of sulfanilamide; recovery.*

In an unmarried 25 year old teacher, otitis media of two weeks' duration had developed on the right seven years previously. About Nov. 1, 1936, pain in the right ear and a few days later a discharge from the right ear had developed. She was admitted to the Northern Liberties Hospital on December 15 with acute mastoiditis and pain radiating to the middle and lower part of the right side of the face. Simple mastoidectomy was performed on the day of admission. This was followed by fever for two days and then by an afebrile, symptomless period for about ten days. On December 21 incomplete peripheral palsy of the right facial nerve developed, with some nystagmus. On Jan. 3, 1937, chills, fever, sweats, general malaise, headache, vomiting and occasional slowness of the pulse developed. About January 4 the patient complained of stiffness of the neck.

Examination on January 4 revealed a lucid patient with slight but definite rigidity in the neck and incomplete peripheral palsy of the right facial nerve. The rest of the observations on neurologic examination were negative. The spinal fluid was under considerably increased pressure and showed close to 800 cells, mostly polymorphonuclears. Organisms were not found on smear or culture.

On January 8, the mastoid incision was revised, and a fistula tract filled with granulation was found over the dura of the middle fossa. The smears from the mastoid pus showed a hemolytic streptococcus. For the succeeding two weeks the patient had a septic temperature, with marked meningeal signs, high spinal fluid pressure and varying pleocytosis. Recovery was appreciably hastened by the use of sulfanilamide, and the patient was discharged in good condition on February 7.

Comment.—This is a case of severe protective meningitis in which, at operation, localized pachymeningitis, both internal and external, was observed. The removal of the infected focus with the establishment of free drainage, as well as the use of sulfanilamide, probably prevented bacterial meningitis.

CASE 10 (M. B.).—*Abscess of the left frontal lobe developing four months after acute ethmoiditis on the right; abscess lateralized by central palsy of the right facial nerve and pineal shift to the right; multiple operations; patient still alive.*

A youth of 17, a mechanic, was admitted to the Graduate Hospital on Jan. 10, 1938. The family history and past medical history were irrelevant. In August 1937 the patient had had ethmoiditis on the right, which necessitated an intranasal operation. He was discharged in two weeks but did not return to work because of general weakness. One month before admission he began to have severe frontal headaches and diplopia on looking to the left. The headaches became worse in severity and duration. One week before admission he had nausea and vomiting and these symptoms again appeared on the day of admission. He became weak and progressively drowsy. The headache was most marked over the left side of the forehead.

Examination on January 10 revealed a weak and drowsy boy complaining of violent headache. The temperature was 99.8 F., the pulse rate 54 and the respiratory rate 24. There was no disorientation or confusion. The fundi showed papilledema (right, 2 D.; left, 3 D.). There were no defects of the field of vision. There was slight weakness of the right lateral rectus muscle and slight but definite central palsy of the right facial nerve. The rest of the observations on neurologic examination were negative. Roentgen examination of the skull demonstrated a pineal shift to the right. Roentgen and clinical examination of the sinuses showed slight mucosal thickening and no other significant abnormality.

On the basis of these findings a diagnosis of abscess of the left frontal lobe of the brain was made. The patient was operated on on January 11, when preliminary probing revealed resistance, possibly of a capsule, in the left frontal lobe. On January 12 operation revealed pus in the left frontal lobe, into which a drain was inserted. During the postoperative period the patient showed witzelsucht. On January 22 the spinal fluid pressure was 420 mm. of water. Increasing intracranial pressure necessitated subtemporal decompression on the right on January 24. Improvement was gradual, and the patient was discharged apparently well on February 26. A follow-up on March 4 revealed no abnormality.

He was readmitted on April 15, because of a return of headache and vomiting. The temperature was 102.4 F. and the pulse rate 100. No neurologic abnormality was noted at that time. On the basis of the previous history a recurrence of the abscess of the brain was suspected. A roentgenogram of the skull, made on April 18, revealed a marked pineal shift to the right. A drain was again inserted into the abscess cavity, and drainage of pus was established. A stormy convalescence ensued, during which right hemiplegia appeared and disappeared. The patient was discharged, much improved, on June 28.

On September 5, he again returned to the hospital, complaining of headache, fever and malaise. The temperature was 101 F. and the pulse rate 96. There was neurologic evidence of mild meningeal irritation. Drainage from the abscess was

again established, and the patient was discharged in good condition on November 6. The pineal body, at this admission, was but slightly shifted to the right.

Comment.—In this case the original sinal infection was on the right side and cleared up, while the abscess of the brain developed on the left in the absence of any active sinal process. This case also emphasizes the diagnostic value of central palsy of the facial nerve and of routine roentgen studies of the skull, as the pineal shift determined the lateralization of the lesion.

CASE 11 (B. G.).—*Nonsuppurative encephalitis; acute otitis on the left, bradycardia, right hemiparesis and aphasia; intracranial exploration with negative results; recovery following mastoidectomy.*

A 13 year old girl, with a noncontributory family history and past medical history, was admitted to the Graduate Hospital on Jan. 28, 1933, with right hemiplegia and aphasia. Two weeks prior to admission infection of the upper part of the respiratory tract had developed, with pain in the left ear and, several days later, cervical adenitis. A week prior to admission aphasia and some weakness of the right side of the body developed.

Objective examination on admission disclosed a rather ill child, with a slight rise in temperature, a pulse rate of 64, a perforation in the left ear drum, some clinical and roentgen evidence of acute mastoiditis, cervical adenitis, bilateral papilledema (2½ D.) with no defects in the visual fields, mixed aphasia and right hemiparesis. Routine laboratory studies showed 10,950 leukocytes and no other significant abnormality.

On January 29 right-sided jacksonian convulsions developed, which lasted fifteen minutes. On the same day the motor cortex was exposed. The dura was darker than normal but pulsated normally, and the cerebrospinal fluid was increased and clear. Exploration for an abscess gave negative results.

On January 30 simple mastoidectomy was performed. Acute suppurative mastoiditis was found at operation. The dura was not exposed.

From the time of the simple mastoidectomy, the patient made slow but steady improvement. At the time of her discharge from the hospital, on March 14, the aphasia, right hemiparesis and choking of the optic disks had completely disappeared.

Comment.—In this case almost classic findings of an abscess of the left temporosphenoid lobe occurred, and the final diagnosis was made by operative procedures and the course of the case. In retrospect it appears that it would have been better to perform the mastoidectomy before attempting cerebral exploration.

CASE 12 (E. K.).—*Nonsuppurative encephalitis; chronic mastoiditis on the left; radical mastoidectomy; labyrinthitis and a second radical mastoidectomy; recurrence of labyrinthitis, Hinsberg operation, palsy of the facial nerve and aphasia, recovery without subsequent operation.*

A woman aged 38 was first admitted to the Graduate Hospital on Sept. 26, 1930, and on September 27 had radical mastoidectomy on the left for a chronic discharge from the ear. The ear continued to discharge, and in addition pain in back of the neck developed. A revision of operative wound on June 2, 1931, gave no relief, and an injection into the occipital nerves in December 1932 relieved the

pain. The patient was readmitted on Oct. 29, 1934, with acute labyrinthitis and had a second radical mastoidectomy on October 29. She was readmitted on Jan. 5, 1936, with symptoms of labyrinthitis. On January 6 she had a Hinsberg operation. The horizontal and semicircular canals and the vestibule were opened. This procedure was followed by complete paralysis of the facial nerve and marked labyrinthine symptoms. In addition aphasia developed, which lasted about ten days. The patient was discharged on January 26, with paralysis of the facial nerve but only a few labyrinthine symptoms. Studies of the spinal fluid are not recorded. Follow-up reports indicate no other complications.

Comment.—The transient aphasia without subsequent development of an abscess of the brain indicates that the patient had *localized encephalitis.* The marked labyrinthine involvement would tend to implicate the posterior fossa. Yet the aphasia shows that the infection extended upward or forward into the middle fossa.

CASE 13 (A. B.).—*Localized nonsuppurative meningoencephalitis due to acute exacerbation of chronic sinusitis; recovery.*

A man 28 years old, a clerk, was admitted to the Graduate Hospital on April 9, 1938. The family history and past medical history were irrelevant except that he had had chronic sinusitis, with an intranasal operation, some years previously. About a month prior to admission acute sinusitis had developed, which improved with treatment. No history of any other recent infection or cranial trauma was elicited. For about ten days prior to admission the patient had had recurrent headaches. On April 12 at 11:30 a. m. he complained of severe frontotemporal headache on the right and considerable twitching of the left side of the face. He then lost consciousness for fifteen to twenty minutes and on regaining consciousness vomited and complained of severe headache. An examination at his home on April 9, 1938, showed a temperature of 100 F., a pulse rate of 88 and normal blood pressure. He was apprehensive but mentally clear. There was a slight elevation of the disk on the left side, central palsy of the left facial nerve, some impairment of the sense of position and marked astereognosis of the left hand. He had no evidences of meningeal irritation.

Throughout his residence in the hospital the temperature was normal except for a slight elevation on April 11. The pulse rate varied between 60 and 90, and the respiratory rate was regular and normal. The routine blood count and the chemical composition of the blood were normal. Studies of the spinal fluid were reported as follows: April 9, 1938, 300 mm. of pressure, 150 cells, predominantly lymphocytes; April 14, 1938, 260 mm. of pressure, 17 lymphocytes, 125 mg. of protein; April 19, 1938, 120 mm. of pressure, no cells, 50 mg. of protein; April 21, 1938, 140 mm. of pressure, 6 lymphocytes, 40 mg. of protein. Other studies of various specimens of spinal fluid gave negative results. Several Bárány tests disclosed no significant abnormality. Repeated studies of the eye showed no diminution in acuity, essentially normal fields and slight elevation of the disks for only several days after admission to the hospital. Roentgen study of the skull gave negative results; that of the sinuses showed some involvement of the left frontal, the ethmoid and both maxillary sinuses. No evidence of osteomyelitis was found.

Within two days after admission to the hospital the sensory changes disappeared, but the central palsy of the left facial nerve persisted. The headache decreased with repeated lumbar punctures and local nasal treatment. When dis-

charged, on April 23, the patient still had some pain in the head and slight central palsy of the facial nerve. He has remained well.

Comment.—This is a case of localized nonsuppurative meningoencephalitis due to sinal disease. The subsidence of the focal signs of involvement of the brain and of the meningitis prevented a cerebral exploration to which there was a strong temptation. Moreover, the patient had sinusitis on the left side with encephalitis on the right, illustrating how the cerebrum may be involved from disease of the sinuses on the opposite side.

CASE 14 (L. B.).—*Diffuse nonsuppurative encephalitis due to sinusitis; recovery.*

A boy aged 15 was admitted to Graduate Hospital on Nov. 30, 1935. The family history was irrelevant. The patient had had scarlet fever at 6 years and osteomyelitis of the left tibia at 9 years. His present illness had begun on Nov. 27, 1935, with coryza and generalized weakness. Within a few hours a temperature of 102 F. developed, and he became drowsy. He remained semistuporous, at times, however, becoming noisy and boisterous. On his admission to the hospital the temperature was 100 F. and the pulse rate 80; he was stuporous but could be aroused, when he became unruly and profane. Neurologic examination showed no abnormality except for marked depression of all tendon reflexes and failure of convergence. The nose was markedly congested, but the sinuses were draining well. Lumbar puncture showed a pressure of 170 mm. of water; the fluid was clear and yielded the following data: cell count 12, sugar content 55, chloride content 660, Wassermann reaction negative. A blood count showed leukopenia (3,600 cells). Roentgen examination of the sinuses showed clouding of the left maxillary sinus, which had the appearance of acute sinusitis. In the succeeding few days the patient became brighter but showed persistence of leukopenia and generalized adenopathy. Three days later erythema developed. From then on his general condition improved, and he was discharged from the hospital in good condition on December 15.

Comment.—This was a case of low grade diffuse encephalitis associated with mild infection of the upper part of the respiratory tract and sinusitis. It is of interest that this mild infection may give rise to intracranial complications. The pathway of infection in this case was probably through the cerebrospinal fluid and the general circulation.

CASE 15 (W. L.).—*Diffuse meningoencephalitis with involvement of multiple cranial nerves, due to minimal sinusitis; recovery.*

A laborer aged 21 was admitted to the Graduate Hospital on April 19, 1932. The family history and past medical history were irrelevant. The onset was two weeks previous to admission with infection of the upper part of the respiratory tract, including sore throat. Five days later fever and malaise appeared. A week prior to admission severe frontal headache and two days prior to admission inability to close the left eye developed.

On his admission to the hospital the temperature was 99 F., with a labile pulse rate, varying between 80 and 120. Otorhinolaryngologic examination showed congestion of Shrapnell's membrane and of the mucous membrane of the nose,

with a mucopurulent discharge on both sides in the region of the middle turbinate, more marked on the left side. The rest of the observations on somatic examination were negative.

Neurologic examination showed a dull and drowsy patient, who could be readily aroused, when he answered questions promptly and accurately. Evidence of meningeal irritation or tenderness over the nerve trunks or muscles was not noted. The patient presented bilateral iritis and papillitis, bilateral ptosis, weakness of both external rectus muscles, hypalgesia of both corneas, peripheral palsy of the left facial nerve and depression of all tendon reflexes. Roentgen examination of the sinuses gave essentially negative results, as did the blood count and other routine blood studies.

On April 21 the patient showed definite paralysis of both superior rectus muscles and a slight Kernig sign. On April 25 nausea and vomiting developed, with evidences of obstruction in the upper part of the gastrointestinal tract. Clinical and roentgen studies of the gastrointestinal tract led to the diagnosis of obstruction high in the small intestinal tract, possibly due to ileus, adhesions or enlarged nodes in the root of the mesentery. Examination at this point revealed a low chloride content of the blood, and the administration of physiologic solution of sodium chloride relieved the nausea and vomiting markedly. On April 27 lumbar puncture showed a pressure of 160 mm. of water. The fluid contained 23 lymphocytes, and the colloidal gold curve was 0011100000. On April 30 the patient showed definite improvement in the condition of the cranio-orbital nerves, but difficulty in swallowing and numbness in the right arm developed. In the succeeding few days he improved rapidly and when discharged on May 11 showed only residual symptoms, palsy of the facial nerve and involvement of the superior rectus muscle, which subsequently cleared up completely.

Comment.—This was a case of severe meningoencephalitis which followed infection of the upper part of the respiratory tract with minimal sinusitis. The condition probably originated from a virus, and the pathway of infection was probably the systemic circulation, for had it been retrograde thrombophlebitis the condition would not have had such wide distribution or recovery been so rapid. The vomiting was undoubtedly associated with disturbance of the central nervous system at the outset but continued later because of alkalosis, emphasizing the importance of disturbances in the chemical composition of the blood in neurologic practice.

CASE 16 (H. B.).—*Adhesive arachnoiditis, attacks of headache, projectile vomiting and papilledema over ten years; adhesions about the optic chiasm disclosed by craniotomy; recovery.*

In a 40 year old tailor, with a noncontributory family history and a history of repeated colds, severe headache and vomiting developed in 1926. He was admitted to a hospital, where the studies revealed only bilateral papilledema. In the course of a few months he made a good recovery. In the latter part of May 1932 he was taken with severe headache, vomiting, dizziness, occasional horizontal dyplopia, general weakness and occasional uncinate fits. When examined on June 10 he showed bilateral papilledema and central palsy and hyperesthesia on the right side. He recovered from this acute episode but continued to have some headache and dizziness and in addition complained of some impairment of

vision and memory. The objective findings on September 20 were the same as on June 10. On Feb. 10, 1933, he complained only of slight headache and slight visual disturbances, and the results of neurologic examination remained unchanged. On Jan. 6, 1934, he complained of headache on the left side and considerable impairment in sight and exhibited bilateral papilledema, central palsy of the right facial nerve and increased reflexes on the right. The Bárány tests at this time gave negative results. The acuity of vision on January 13 was 6/12 in the right eye and 6/60 in the left eye, and he showed bilateral papilledema. Roentgen examination on January 22 showed deformity of the sella turcica, consisting chiefly of an increase in size (anterior pituitary measurement, 16 mm.; depth, 9 mm.). There appeared to be some erosion of the anterior clinoid processes. These roentgen findings suggested the possibility of an intracranial lesion, probably in the anterior cranial fossa. A careful study of the sinuses disclosed no significant abnormality. The patient continued to have recurrent headache and dizziness, with progressive loss of vision in both eyes. Roentgen studies on Sept. 9, 1936, showed further increase in the sella and, in addition, erosion of the top of the dorsum sellae. The picture suggested a suprasellar tumor.

On October 3, at the Graduate Hospital, after an encephalogram had been made, transfrontal craniotomy on the right disclosed arachnoiditis in the suprasellar region and adhesions about the optic nerves and chiasm. The adhesions were freed. The patient made a good surgical recovery despite postoperative pleurisy. A note made on Sept. 10, 1938, stated: The patient had no subjective complaints. The disks and the visual fields were grossly normal.

Comment.—This case falls definitely into the group of cases of arachnoiditis producing symptoms strongly suggestive of tumor of the brain. The long duration and periods of remission are of considerable interest. It must be assumed that the arachnoiditis was associated with periods of interference with the circulation of the cerebrospinal fluid corresponding to the episodes of marked symptoms of increased intracranial pressure.

CASE 17 (E. L.).—*Otitic hydrocephalus; acute otitis and mastoiditis, with simple mastoidectomy; thrombosis of the lateral sinus, with ligation; headache, vomiting and papilledema; recovery with lumbar punctures.*

In a girl aged 8 years, with an irrelevant family history and past medical history, otitis and mastoiditis developed on the right side in February 1936, with incomplete palsy of the facial nerve, for which she had simple mastoidectomy at the Northern Liberties Hospital. This was followed by cervical adenitis and thrombosis of the lateral sinus, for which the right jugular vein was ligated. She had a rather stormy convalescence and was doing well, when, late in May 1936, headaches, vomiting and some difficulty with vision developed.

On admission to the Graduate Hospital on June 19 she had 4½ D. of choking of the optic disks on the right and 3½ on the left, horizontal and vertical nystagmus and no other clinical neurologic abnormality. The first spinal tap showed a pressure of 240 mm. of water; the fluid contained 11 lymphocytes and was normal in other details. Urinalysis, blood counts, chemical study of the blood and roentgen examination of the skull gave negative results.

The papilledema began to recede after the first spinal tap. Three additional taps were performed, the pressure gradually receding to 140 mm. of water. There was only occasional headache and no vomiting. The patient was discharged

from the hospital on July 16 with only slight elevation of the disks. Follow-up reports indicated complete recovery.

Comment.—This was probably a case of the type of condition described by Symonds as otitic hydrocephalus. While it is true that papilledema sometimes follows ligation of the jugular vein, there is usually not such a high degree of choking of the optic disks, and accompanying neurologic abnormalities are not seen.

CASE 18 (A. McC.).—*Otitic hydrocephalus; acute otitis and mastoiditis, with simple mastoidectomy, headache and papilledema; recovery after reoperation and removal of diseased bone.*

A woman aged 34 was admitted to the Graduate Hospital on April 21, 1933. The family history and past medical history were irrelevant. About four weeks prior to admission acute otitis and mastoiditis had developed on the left, for which she had had simple mastoidectomy. Since the operation, she had had generalized headache, more marked on the left side. A spinal tap performed prior to admission to the Graduate Hospital showed considerable elevation in spinal fluid pressure. The fluid contained 3 lymphocytes and was otherwise normal.

Physical and neurologic examinations showed no abnormality except for elevation of the disks of less than 2 D. Vestibular tests indicated hyperactivity of the left labyrinth. Routine blood studies gave negative results. Roentgen examinations revealed a suppurative process around the sinus, proximal to the knee on the left side.

On April 28 the mastoidectomy wound on the left was reopened and the cells cleaned out. Recovery was uneventful and when discharged, on May 9, the patient was free from pain, and the disks were receding. Follow-up reports indicated that she made a complete recovery.

Comment.—This case emphasizes the importance of eradicating the foci of infection in cases of otitic hydrocephalus.

CASE 19 (A. K.).—*Chronic otitis on the right, with acute exacerbation; radical mastoidectomy on the right, followed by thrombosis of the left cavernous sinus, which at autopsy was shown to be due to disease of the left temporal bone.*

A woman aged 37, with an irrelevant family history, who had had pneumonia on three occasions and was subject to frequent colds, was admitted to the Harrisburg Hospital on Sept. 13, 1938, complaining of pain in the right ear. The hearing in the right ear had been poor for years. On Aug. 1, 1938, pain in the right ear and fever had developed, but no aural discharge. She had been bedridden from August 24 to the time of admission to the hospital.

Objectively, on admission she was malnourished, with a temperature of 101, a pulse rate of 110, a respiratory rate of 20 and a blood pressure of 110 systolic and 70 diastolic. Mentally the patient was lucid. Neurologic examination gave negative results. There was tenderness over the right mastoid. Roentgenograms revealed necrosis in the anterior superior portion of the right mastoid, directly above the external auditory meatus. The left mastoid appeared normal. There were leukocytosis (14,550 leukocytes, with 57 per cent polymorphonuclear cells), secondary anemia and some albuminuria.

On the day of admission radical mastoidectomy was performed. Suppuration engrafted on an old cholesteoma, with granulations over the sigmoid sinus, was the chief finding. The dura of the middle fossa was exposed and found normal.

The patient's condition was good for two days, and then she gradually became dull and later semistuporous. On September 19 there was some rigidity of the neck, the right pupil was larger than the left and the reflexes of the left knee and achilles tendon were increased over those of the right. The spinal fluid pressure was normal, and there were 4 cells. On September 20 proptosis of the left eye appeared, and there was engorgement of the retinal vessels in both eyes. On September 21 there was marked proptosis of the left eye, with marked edema with prolapse of the conjunctiva and immobility of the eyeball. The spinal fluid pressure was 21 mm. of mercury, but the fluid findings were negative. The temperature and pulse rate gradually increased, and the respirations became irregular. The patient died on September 23.

The autopsy showed the right middle fossa filled with yellow-greenish pus. A large subdural abscess in the right middle fossa was compressing the lateral portions of the frontal, the temporal and the occipital lobe. The lateral and the cavernous sinus on the left contained a large amount of creamy pus. There were suppuration and necrosis of the petrous portion of the left temporal bone.

Comment.—This case by itself illustrates many of the difficulties and tragedies of neurologic complications of disease of the temporal bone. Ten days prior to the patient's death a thorough exploration failed to disclose any beginning of a subdural abscess. Two days prior to her death the spinal fluid showed no evidences of purulent meningitis. The cause of the thrombosis of the cavernous sinus on the opposite side, due to extensive disease of the temporal bone on the left side, was not even suspected until the autopsy was performed.

THE LARYNX IN INFANTILE BERIBERI

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Infantile beriberi remains a major medical problem in the Philippine Islands. Its yearly toll of infant lives is enormous, challenging the imagination and demanding the cooperative effort of every physician in the country. In 1928, according to Professor Albert,[1] the foremost worker on the subject today in the country, "the Philippine Committee on Beriberi [2] stated that infantile beriberi claimed an average of 16,500 deaths annually among infants alone, representing 28.10 per cent of the total deaths among infants under 1 year of age." It is still in the shadow of half knowledge. Albert stated in one of his articles, "I wish to encourage the interest of other workers, particularly clinical towards this question, still mysterious in its appearance, diagnosis and treatment."

The present work has been actuated by a desire to contribute, if only in a small measure, to the clinical study of infantile beriberi. The department of pediatrics of the Philippine General Hospital has given us wholehearted cooperation, not only in supplying us with cases but also in giving us valuable suggestions in this clinical investigation of a phase of infantile beriberi in which the pediatrician and the laryngologist are mutually interested. Our main problem is this: Could something of clinical value, diagnostic or otherwise, be gained by the examination of the larynx in infantile beriberi? Is it worth while for the pediatrician to have the larynx examined in every case of hoarseness in children? [3]

Hoarseness and weakness of the voice, sometimes aphonia, are among the most frequent symptoms of infantile beriberi. "It is a clinical fact,"

Read at a meeting of the Clinical Club of the Philippine General Hospital, Oct. 23, 1938.

From the Department of Ophthalmology and Otorhinolaryngology, College of Medicine, University of the Philippines.

1. Albert, J.: Studies on Five Hundred Fourteen Cases of Infantile Beriberi, Philippine J. Sc. **45**:297 (June) 1931.

2. Lopez Rizal, L.: Report of the Committee on Beriberi, J. Philippine Islands M. A. **8**:422 (Oct.) 1928; cited by Albert.[1]

3. Alcantara, V. C., and de Ocampo, G.: Bronchoscopy-Minded, J. Philippine Islands M. A. **17**:465 (Aug.) 1937.

according to Albert,[4] "that the aphonic form constitutes from 80 to 90 per cent of all cases of infantile beriberi." Not only is aphonia the most frequent symptom, but it is the one that stays to the last.[5] Albert[4] stated: "So long as the voice has not recovered its normal pitch, the infant is constantly threatened by an acute attack which may terminate in death in a few hours." Yet, in spite of the significance of this symptom, the condition of the larynx in infantile beriberi has been studied meagerly abroad and never before in this country. Textbooks[6] on laryngology do not mention it. Fernando[7] in 1924 reported 2 cases of adult beriberi in which the left vocal cord was completely paralyzed, but he made this statement: " . . . among infants in whom hoarseness and aphonia have been more constantly observed, I have not attempted any laryngoscopic examination to determine the lesion in the larynx, especially in the cords. Albert[1] stated: "It should be noted that so long as we consider this disease as adult beriberi in miniature, we shall be committing a gross mistake. Infantile beriberi differs from adult beriberi in almost every particular; pathological, clinical, and therapeutical." However, de Langen and Lichtenstein[5b] maintained that the pathologic changes in infantile beriberi are the same as those in adult beriberi. Haridas,[8] in his report of 102 cases of infantile beriberi observed in Singapore, British Malaya, stated: "Direct laryngoscopy performed on a series of cases by Mr. B. M. Johns, Surgeon and Otorhinolaryngologist at the General Hospital revealed that there was edema round about the arytenoids." According to Katsuji Kato,[9] "Kubo first demonstrated by laryngoscopic examination that this symptom [aphonia] was due to the paralysis of the left recurrent laryngeal nerve. The vocal band often shows a disturbed abduction and a later fixation." It is therefore evident

4. Albert, J.: The Treatment of Infantile Beriberi with the Extract of Tiqui-Tiqui, Philippine J. Sc. (Sect. B) **10**:81 (Jan.) 1915.

5. (*a*) Chamberlain, W. P., and Vedder, E. B.: The Care of Infantile Beriberi by the Administration to the Infant of an Extract of Rice Polishing and the Bearing Thereof on the Etiology of Beriberi, Bull. Manila M. Soc. **6**:26, 1912. (*b*) de Langen, C. D., and Lichtenstein, A.: A Clinical Text-Book of Tropical Medicine, translated by A. H. Hamilton, Batavia, G. Kolff & Co., 1936. (*c*) Albert.[4]

6. (*a*) Jackson, C., and Jackson, C. L.: The Larynx and Its Diseases, Philadelphia, W. B. Saunders Company, 1937. (*b*) Jackson, C., and Coates, G. M.: The Nose, Throat and Ear and Their Diseases, ibid., 1929. (*c*) Thompson, St. C., and Negus, V. E.: Diseases of the Nose and Throat, New York, D. Appleton-Century Company, 1937.

7. Fernando, A. S.: Laryngeal Symptoms in Beriberi, Philippine J. Sc. **24**:41 (Jan.) 1924.

8. Haridas, G.: Infantile Beriberi, J. Malaya Br. Brit. M. A. **1**:26 (June) 1937.

9. Kato, K.: Beriberi in Infancy and Childhood, in Brennemann, J.: Practice of Pediatrics, Hagerstown, Md., W. F. Prior Company, Inc., 1937.

that there is confusion and insufficient observation of the laryngeal lesions in infantile beriberi, as found by these Japanese and English workers.

CLINICAL OBSERVATIONS

Our present clinical investigation covers over two years, and our material includes 37 cases of infantile beriberi. For control we have observed 31 cases of hoarseness from other causes in children. All of the 68 patients were admitted to the department of pediatrics of the Philippine General Hospital. We submitted all of them to direct laryngoscopic examination without anesthesia. Usually the only preparation was to give nothing by mouth for at least six hours before the laryngeal examination. With training, there should be no difficulty in examining the larynx of even the youngest infant. Jackson and Jackson [6a] stated in this connection:

> The larynx of any human being whose mouth can be opened, of any age from the newborn to the person dying of senility, can be examined. No man worthy of the name of laryngologist should commit himself to a diagnosis without such an examination.

In only 1 case, in the control group, was the examination not thorough, because of the spasm of the glottis on insertion of the laryngoscope, causing signs of asphyxia.

The examination takes only from a few seconds to a few minutes. It must be done gently and fast but not so hurriedly as to preclude a thorough and accurate observation of the different parts of the larynx, particularly the motion of the vocal cords. A glimpse of the glottis is not sufficient to determine the motility of the cords. It is necessary in many cases to wait for the child to cry and observe the movements of the cords. The child's anterior commissure laryngoscope should be inserted gently deep enough to hold the slippery epiglottis, but not deep enough to injure the vocal cords or to produce laryngostasis, which would give a misleading impression of fixity of the vocal cords. Sufficient time should be taken also to get a smear from the larynx or apply local medication when necessary.

The diagnosis of infantile beriberi alone or in combination with other diseases has been given in these cases by members of the department of pediatrics, whose clinical criterion depends on several factors, some or all of which might be present in a particular case. These are a history of breast feeding, "pastous constitution" of the child, enlarged heart, characteristic symptoms and signs and improvement or recovery on administration of vitamin B. Of the 37 cases of infantile beriberi, 5 were of acute cardialgic, 15 of aphonic, 16 of combined cardialgic and aphonic and 1 of mixed cardialgic, aphonic and pseudomeningitic beriberi. Some of these were of beriberi associated with other diseases or the mixed

forms of Guerrero and Quintos.[10] Two patients had acute bronchitis with aphonic beriberi; 8 had bronchopneumonia with beriberi; 3 had enlarged thymus observed roentgenologically; 1 had tracheobronchitis with beriberi, and 1 had malnutrition secondary to hypogalactia of the mother, so that beriberic syndrome instead of infantile beriberi was given finally as a diagnosis. The youngest was 1 month of age and the oldest 9 months. Only 7 were older than 4 months. Twenty-three were from Manila and the rest from Rizal and Cavite. All of them were Filipino infants. Weakness of the voice ranging from hoarseness to complete aphonia was the most frequent symptom. Among the other complaints were crying, cyanosis, dyspnea, rolling of the eyeballs, rigidity of the body, frequent and scanty urination, choking during breast feeding, coldness of the body, moaning, prostration, restlessness, cough and fever. Rapid heart rate and accentuation of the second pulmonic sound were frequent findings. Many times the lids were edematous and the face puffy. Leukocytosis was a common finding in patients with pulmonary complication.

Roentgenograms in 23 cases revealed enlargement of the heart without qualification as to the direction of the enlargement. Five patients were reported to have cardiac enlargement to the right and 5 to the left, while only 4 had no cardiac enlargement. Pulmonary changes varying from infiltration with beginning consolidation to distinct bronchopneumonic changes were present in 12 cases. Enlargement of the thymus was suspected on the basis of the roentgenograms in 3 cases.

All of the 37 patients received therapy with vitamin B in some form or another. To the 12 patients with pulmonary complications, besides the vitamin preparations, such anti-infective medicaments as redoxon (a synthetic vitamin C preparation), blood injected intramuscularly, quinine and quinine ethylcarbonate were given. Symptomatic medication with citrates, chloral hydrate, strychnine, sodium bromide, caffeine, phenobarbital and aminopyrine were given as indicated. In the case of hypogalactia of the mother, artificial feeding was the main adjuvant to vitamin therapy.

There was no death in this series of 37 cases of infantile beriberi; 28 patients improved considerably before they were discharged, and 9 recovered completely except for slight impairment of the voice, which in the majority of the cases persisted from several weeks to two or three months. It was also observed by one of the members of the resident staff of the department of pediatrics, who followed up some patients, that the duration of the impairment of the voice seems to be little influenced by continuing the vitamin B medication after the other symptoms have improved.

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10. Guerrero, M., and Quintos, J.: El beriberi en los niños de pecho, Manila, Imprenta de Lorenzo Crib, 1910.

The findings by direct laryngoscopic examination might be summarized as follows: The right vocal cord was paretic or could not move completely to the median line in 4 cases, stayed immobile in the median line in 9 and assumed a cadaveric position in 3. The left vocal cord was paretic in 5 cases, completely immobile in the median line in 9 and cadaveric in 1. The vocal cords were bilaterally impaired in 3 cases. The paretic vocal cord appeared at a lower level than the normal cord in 3 cases. All the 5 patients with acute cardialgic beriberi, in whom the impairment of voice was slight, showed only slight congestion of the vocal cords, the mobility of which was normal. In 1 case of mixed cardialgic and aphonic beriberi, the vocal cords were much congested, pinkish and flapping somewhat loosely on respiration, with slight impairment of motion on the left side. After twelve days the voice was much improved, and another laryngoscopic examination revealed no more congestion, but the left cord was slightly paretic. In another case, the left vocal cord was in the median line when first examined. After thirty-seven days in the ward, when the voice was practically normal, the cord appeared in the same position as at the first laryngoscopic examination. There was an interesting case, in which direct laryngoscopic examination was done four times. At first the left vocal cord was cadaveric. After one week there was no appreciable improvement in the voice and no change in the laryngoscopic picture. After twelve days more, the voice was improving, and the left vocal cord was slightly mobile but not completely coaptated with the right. After one more week, the voice was much improved, and the left vocal cord almost completely reached the other cord in the median line. We did not discover any sensory disturbance of the larynx in these infants. We presume that to elicit evidence of such disturbance in infants would be difficult.

There was a case of acute cardialgic and aphonic beriberi in which the heart was enlarged and the right vocal cord appeared immobile in the median line at the first laryngoscopic examination. Two weeks later, before the child was discharged with all symptoms improved except the hoarseness, a second roentgenogram revealed the heart much smaller, but laryngoscopic examination showed practically no change in the position of the vocal cords. However, in the case of the malnourished infant with an aphonic beriberi syndrome secondary to hypogalactia of the mother, the paresis of the left vocal cord completely disappeared in twelve days.

During the last three years, we have examined also a control group of 31 cases of children with diseases other than infantile beriberi whose ages varied from 18 days to 3 years. Two thirds of them were below 6 months old. Hoarseness was present in almost all cases. The other prominent symptoms were cough, cyanosis, vomiting, fever, dyspnea,

noisy respiration, nasal catarrh and frequent bowel movements. Rales were noted in many of them. Of these 31 cases the final diagnosis given by the pediatrician was acute bronchopneumonia in 10, acute laryngotracheobronchitis in 7, lobar pneumonia or bronchopneumonia with acute laryngitis in 7 and tuberculous bronchopneumonia, enlarged thymus, acute bronchopneumonia with septicopyemia, acute ileocolitis with bronchopneumonia and acute laryngitis, lobar pneumonia complicated with empyema of the chest, pertussis and paroxysmal and protracted bronchopneumonia with postdiphtheritic paralysis in 1 case each.

Roentgenograms of the heart and lungs in 17 cases of the control group revealed pulmonary lesions in 13 cases, ranging from opacity in the hilar region to pneumonic or bronchopneumonic changes. Nine hearts showed lesions, of which 4 were said to be slightly enlarged without qualification as to the direction of the enlargement and 5 showed enlargement to the left. Culture from the larynx, taken in 16 cases, showed Staphylococcus in 7, Pneumococcus in 6, Streptococcus haemolyticus in 5, Monilia in 2 and Bacillus diphtheriae in 1.

The summary of the laryngeal lesions in the control group is as follows: One patient had spasm of the glottis with consequent signs of asphyxia during laryngoscopic examination, so that the examination was discontinued. Twenty-two patients showed congestion of the larynx, particularly of the true vocal cords. In some patients the congestion involved the arytenoids and false vocal cords more, and some had secretion in the glottis. In all the patients, however, the mobility of the vocal cords was practically normal. In 8 patients of the control group, however, besides the slight congestion, there was impairment of motion of the vocal cords. In the patient with tuberculous bronchopneumonia, the right vocal cord stayed immobile in the median line; the patient with enlarged thymus had slight paresis of the right vocal cord; the one with septicopyemia had a cadaveric left vocal cord; 1 had distinct postdiphtheritic paralysis of the soft palate besides the paresis of the vocal cords; 1 patient with malnutrition, who had impaired mobility of the left vocal cord and an enlarged heart, was provisionally considered to have beriberi and improved after one month of administration of vitamin B_1 preparations. The patient with bronchopneumonia associated with malnutrition, immobility of the right vocal cord and a normal heart had a markedly improved voice after two weeks, without vitamin B_1 medication. One patient, who had aphonia with paralysis of the left vocal cord and bronchopneumonia, regained normal voice in four days. One patient with acute laryngotracheobronchitis and congestion of both vocal cords had slight impairment of motion of the left side, but without vitamin B_1 therapy the hoarseness was gone in one week.

COMMENT

A comparison of the laryngeal findings in the cases of infantile beriberi with those in the control group shows the outstanding significance of the impairment of motion of the vocal cords in the explanation of the hoarseness in infantile beriberi. Of the 37 patients with infantile beriberi examined laryngoscopically, only the 5 cardialgic patients showed no impairment of mobility of the vocal cords. All the rest had impaired motion of either the right or the left or both vocal cords, the severity varying from slight paresis with immobility in the median line to complete paralysis giving the cadaveric position. In those with complicating infection, mostly of the respiratory tract, the impaired motion of the vocal cord was evident even when an appreciable congestion was coexistent or after this had disappeared. It is noticeable also that the impairment of motion of the vocal cords remains for a long time, in most cases lagging behind the slow clinical improvement in the voice of the infant. In contrast, practically all the patients in the control group showed only congestion, with no impaired motion unless there was coexistent some such condition as tuberculosis, diphtheria, enlarged thymus or septicemia, which might explain the paresis, or paralysis. At least, in the few cases in which no satisfactory explanation existed for the impaired mobility of the cord except the inflammation of the larynx, the voice and the motion of the cords returned to normal much sooner than when of beriberic origin.

The diagnostic significance of these clinical observations is evident. In a given case of hoarseness or weakness of the voice in an infant, an impairment of the motion of the cords, which can be detected only by direct laryngoscopic examination, points to a beriberic origin or deficiency of vitamin B_1 when no other or more probable etiologic condition exists, especially when it persists for some time. Acute laryngitis, bronchitis and bronchopneumonia may produce congestion of the larynx and cords but rarely, if ever, impair appreciably the motion of the cords. If they do, the impairment may be secondary to concomitant arthritis of the cricoarytenoid joint or occasionally myositis, especially of the thyroarytenoids, and the ankylosis of the joint may be detected by palpation. The element of congestion may be considerable, but this subsides, usually within a short time, and the hoarseness and impaired mobility of the cord likewise do not last long. We recognize that persistent crying in an infant, which may in some cases be the precursor of an acute attack of beriberi, may cause some degree of hoarseness, but if they are only secondary to the crying, the hoarseness and congestion of the cords are short lasting, and there is no paralysis. It must be recognized and admitted that deficiency of vitamin B_1 (beriberi) and infection, usually of the respiratory tract, may coexist. The infection may make manifest a

latent or subclinical deficiency of vitamin B, or the hypovitaminosis may predispose to infection. Either singly may give rise to hoarseness or weakness of the voice. When they occur in combination, it becomes a diagnostic problem to determine which causes the hoarseness, whether a deficiency of vitamin B_1 coexists with the infection and, if so, to what degree. We believe that in such cases, which are frequently observed, laryngoscopic examination will bring much light to the problem, and we hope the pediatrician will come to recognize and appreciate this more and more. We believe also that impaired mobility of the vocal cord should be added to the bases for the diagnosis of infantile beriberi, heretofore generally recognized as breast feeding, cardiac enlargement, "pastous constitution," clinical symptoms and response to the therapeutic test.

We have made the foregoing clinical observations. The clinical fact remains, whatever may be its pathologic basis or the modus operandi of the agents which bring it about. We realize that some may disagree with us in what we are going to offer as explanation for the observed clinical facts. Hoarseness should be distinguished from weakness of the voice. It is usually difficult to differentiate them in infants. The explanation of the impaired motion of the vocal cords seems to turn on the vagus nerves, which innervate the intrinsic musculature of the larynx. In 1908 Albert [11] with the collaboration of Marshall and Gilman showed the presence of degenerative neuritis of the vagus nerve by autopsy of a 3 month old child with typical cardiac beriberi. Albert [4] in 1915 wrote:

> The failure of the extract [of tikitiki] to cure the aphonia can be attributed to a very advanced degenerative neuritis of the recurrent branches of the vagus nerve, which are the first to be affected in all cases of dietetic deficiency.

Fernando expressed the opinion that the paralysis of the vocal cord in his 2 cases of adult beriberi was probably due to degeneration of the pneumogastric nerve. Although, according to Weiss and Wilkins,[12] the theory of origin in the vagus nerve is less plausible than the myogenic theory as an explanation of the circulatory disturbances in adult beriberi, the laryngeal lesions causing the aphonia can be explained well by the nerve degeneration theory. One point strongly in favor of the neural rather than the myogenic mechanism is the long duration of the hoarseness or aphonia. It must be remembered also that in many cases of degeneration of a nerve there is first a stage of irritation or irritability of

11. Albert, J.: A Case of Infantile Beri-Beri, with Autopsy Report, Philippine J. Sc. (Sect. B) **3**:345 (Sept.) 1908.

12. Weiss, S., and Wilkins, R. W.: The Nature of the Cardiovascular Disturbances in Nutritional Deficiency States (Beriberi), Ann. Int. Med. **11**:104 (July) 1937.

the nerve fibers. This might be the cause of exaggerated knee jerk in some of the cases of incipient beriberi in adults. Albert [4] in 1915 stated "that infantile beriberi under a clinical aspect is principally a vagotonia—an abnormal irritability of the vagus."

In regard to paralytic diseases of the larynx, it is well to remember Semon's law, which, according to Jackson and Coates,[6b] should be considered more of a rule than a law, as there are exceptions. It states that in organic lesions of the recurrent laryngeal nerve or the center from which it is derived the abductor fibers are affected first, the tensors second and the adductors last. According to Negus [13] this rule follows evolutionary changes, since in the phylogenetic scale the abductor fibers are the latest to be acquired and they are therefore more vulnerable although not necessarily more superficial.

How shall one explain the different kinds of paralysis by this rule of Semon? In the first place, the paresis that we observed was a sluggishness and limitation of the movement of the cord medially, so that it did not reach the other cord at the median line. We have not observed well whether the cord has also any impaired mobility outward. This observation may be explained by paralysis of the adductors, but this is usually functional and rarely occurs initially and alone, and hence the possibility is remote. It may be due to increased tonicity from irritability of the abductors causing them to counteract the adductors. This would produce the sluggish and limited medial motion of the cord. The latter consideration is possible if one believes that irritability of the whole vagus nerve or only of its abductor fibers may occur before the degenerative changes take place. This may not exactly conform with the results of experimental stimulation of the vagus nerve,[6a] because it is difficult to stimulate electrically or otherwise only the abductor fibers without stimulating also the adductor and the tensor fibers.

Then, in the more advanced stage, when the abductor fibers have degenerated, the adductors, unopposed, keep the cord immobile in the median line. But one must assume the existence of some paresis or weakness of the tensors to produce hoarseness even when the two cords approximate in the median line. When the tensors are much affected, the cord may be so lax as to appear to lie below the level of the opposite normal cord, as is observed in some cases. Again, the influence of the tensors may be cited to explain the observation of an improved or normal voice with one cord persistently immobile in the center. In such cases, the tensors must have recovered but not the abductors, and the cord becomes tense and vibrates although immobile in the median line.

13. Negus, V. C.: The Mechanism of the Larynx, St. Louis, C. V. Mosby Company, 1929.

In the final stages, when the degeneration has involved practically all the nerve fibers, abductors, tensors and adductors, the cord shows complete paralysis and assumes the cadaveric position.

We would quote in this connection the following statement by Jackson and Jackson [6a]:

> Pathologic considerations are fundamentally important; but as clinicians we must remember that any one or more of the three groups of muscular systems may be affected unilaterally and bilaterally. We should be guided entirely by our knowledge of anatomy and of the normal laryngoscopic image and record what we see objectively when examining the larynx.

These clinical observations that we have made in infantile beriberi point to the pathologic similarity of adult and infantile beriberi, at least in the laryngeal lesions. As to the cause of this vagal degeneration, cardiac pressure seems remote, since some of the patients have no cardiac enlargement and among those who do there exists no constant correspondence between the side of the heart enlarged and the cord paralyzed. According to the most widely accepted view, the cause is deficiency of vitamin B_1. This view is supported by the clinical improvement that occurs when vitamin B_1 is administered. In the final analysis, according to the recent theory that intoxication brought about by an intermediate product causes the neural and myocardial degeneration and other lesions, they are still indirectly caused by deficiency of vitamin B_1. Is it possible also that the different types of impaired motion of the vocal bands need not exactly represent stages of severity in all cases but are evidence of the so-called focal localization of deficiency of vitamin B_1?

SUMMARY AND CONCLUSIONS

Thirty-seven patients with infantile beriberi, of whom 5 had acute cardialgic, 15 aphonic, 16 combined cardialgic and aphonic and 1 mixed cardialgic, aphonic and pseudomeningitic beriberi, were submitted to direct laryngoscopic examination. Eleven of them had the disease complicated by acute infection of the respiratory tract. The youngest was 1 month of age and the oldest 9 months. All except 7 were below 4 months old. Hoarseness and weakness of the voice, or aphonia, was the most frequent symptom. The final diagnosis of infantile beriberi was given in all these cases by the pediatrician.

The laryngeal lesions found may be summarized as follows: The 5 patients with acute cardialgic beriberi, in whom the impairment of voice was slight, showed only slight congestion of the vocal cords, their motility being normal. All the rest had impairment of motion of the vocal cords. The right vocal cord was paretic or could not move completely to the median line in 4 cases, stayed immobile in the middle in 9 cases and assumed a cadaveric position in 3 cases. The left vocal cord

was paretic in 5 cases, completely immobile in the median line in 9 cases and cadaveric in 1 case. The vocal cords were bilaterally affected in 3 cases. In some cases the paretic vocal cord appeared at a lower level than the normal.

A control group of 31 children with diseases other than infantile beriberi but with hoarseness as a complaint also were examined laryngoscopically. Twenty-two of these showed only congestion of the vocal cords, which moved normally. The rest had impairment of movement of the vocal cord, but in almost all of them there was a coexistent pathologic condition which might explain the paresis. In the rare cases in which the impairment of motion seemed to be entirely attributable to the inflammatory congestion of the larynx, the hoarseness and the impaired mobility were short lasting in contrast to their long duration in the cases of beriberi.

We believe that impaired mobility of the vocal cords should be added to the already recognized factors in the criterion for the diagnosis of infantile beriberi. In cases in which beriberi and acute infection of the respiratory tract coexist, the motility of the cords is of help in determining whether both are present and what degree of deficiency of vitamin B_1 exists in the child.

The modus operandi in the production of the clinical facts observed seems to be first the irritation and then the degeneration of the abductor fibers of the vagus nerve followed by similar changes in the other fibers, the tensors and adductors. The cardiac enlargement does not seem to have any influence on the degeneration.

Clinically and probably pathologically, at least with regard to the laryngeal lesions, there is a close similarity between adult beriberi and infantile beriberi.

OROANTRAL OPENINGS AND THEIR SURGICAL CORRECTION

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If the maxillary sinus is opened in the course of the removal of a tooth or during some other oral operation, several clinical signs give immediate warning. The more common ones are escape of blood from the nostril, escape of air into the oral cavity during expiration, frothing of blood from the tooth socket and escape of liquids from the mouth through the nostril. These signs are often followed rapidly by local pain and inflammation within the sinus. Even suppuration and empyema may supervene within twenty-four to forty-eight hours. Furthermore, these local manifestations may be supplemented by more or less pronounced general symptoms of acute infection.

In addition to the infection, the following important factors, besides others, help to determine the effect of the opening in individual cases: the cause of the opening; the conditions under which it occurred; its duration; the extent of immediate laceration of, and later changes in, the surrounding tissues; the location of the opening; the presence of adjoining teeth; the presence of pathologic conditions around the site of the removed tooth, and, finally, the condition of the sinus proper and of the associated anatomic structures.

A considerable proportion of these openings close by granulation, as would an ordinary tooth socket. In a certain percentage, closure is delayed but still takes place without surgical intervention. In other cases, the opening remains patent and can be closed only by means of an operation. In any case natural closure should be encouraged and not retarded or prevented by unnecessary or injudicious packings of the tooth socket carried into the sinus.

PRELIMINARY CONSIDERATIONS

Dental Relations and Local Pathologic Conditions.—It is well to have a clear understanding of the dental relations and the nature of the local pathologic conditions, since these induce characteristic morbid processes which should influence or determine the mode of treatment.

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Specifically, it is important to know whether the tooth removed was alive or devitalized and infected and whether there was any pathologic condition around the tooth, such as a cyst, granuloma or abscess of bone. These pathologic processes may in themselves directly penetrate into the maxillary sinus. On the other hand, neoplasms of the maxilla which invade the maxillary sinus are comparatively rare and will not be considered in this article.

In the removal of normal teeth the sinus may be broken into because of the anatomic relation or through natural inadvertence in the operative procedure. Infection may develop soon even in clean openings of this type, but it frequently yields to thorough irrigation if instituted promptly, the cannula being introduced into the oral opening and the fluid escaping through the nostril with the patient's head bent forward. In such cases the opening often granulates and closes uneventfully.

The presence of infected teeth, the roots of which project into the sinus proper, often leads to an acute or chronic suppurative process, usually characterized by periodic exacerbations, degeneration of the lining membrane and formation of polyps. Chronic fistulous dental abscesses presenting little or no roentgenographically demonstrable destruction of bone may drain into the sinus. Sometimes a pyorrhea pocket is found extending beyond the end of the root of a tooth and into the maxillary sinus. Such a pocket acts like an abscessed tooth. These findings should not, however, be construed as meaning that the presence of devitalized teeth is necessarily an etiologic factor in sinal infection. Such unmeasured conclusions are prone to lead to erroneous diagnosis and to unnecessary loss of teeth. Roentgenograms are helpful and often dependable diagnostic agents in this connection, but they should be interpreted with the utmost care.

Cysts and granulomas, often associated with diseased teeth, are structurally circumscribed, and, even though infected, they give some protection to the surrounding bone, often invaginating the approximating wall or laying bare the schneiderian membrane without actually penetrating it. Larger cysts may become continuous with the sinus. When acute suppuration develops, the pus may evacuate into the maxillary sinus.

Pathologic Conditions of the Sinus.—The condition of the sinus proper should be determined as clearly as possible. The maxillary sinus often harbors low grade infections without causing disturbing symptoms. It may be assumed, therefore, that the acute symptoms which arise when these unexpected openings are formed are not always due to the entrance of oral bacteria, as in a large proportion of cases no infection develops despite the unavoidable contamination. Some may be due to the activa-

tion of an existing dormant infection. Nevertheless, the likelihood that infection follows because of the opening cannot be excluded. Cases in which ascending infection developed with fatal results have been reported. The extent of trauma, the bacteriologic picture and the proneness of the patient to infection also should be considered as factors in the final determination of the cause.

An anteroposterior roentgenogram taken immediately on establishing such an opening may be suggestive in this respect. If there is no history of previous difficulty and the sinus appears to be clear, it may be assumed that it was normal. If the roentgenogram of the sinus shows clouding, which is commonly, though not always, caused by pathologic changes, it may be assumed that a chronic infection has existed there before.

When one is preparing to close a sinus the existing condition should be carefully studied. The previous history, the roentgenogram and transillumination are helpful and suggestive, but the actual condition is best disclosed at operation.

When diseased teeth are present, the diseases which affect the bony floor are not easily demonstrated by the roentgenograms and for this reason or from want of appreciation are frequently overlooked. The bone may be necrotic or permeated with pus. Within the cavity masses of crumbling polyps mixed with pus and other detritus usually accumulate in consequence of prolonged chronic inflammation and suppuration. The membrane lining the floor and the lower third of the cavity may be necrotic while a large part of that covering the upper part of the cavity is intact and normal in appearance.

The aim should be to remove the diseased portion and preserve the apparently good part of the lining membrane. The diseased membrane is of poor texture and often jelly-like and can be wiped away with a sponge or removed with a ring curet.

Prognosis.—This discussion is confined to cases in which the disease is of dental origin and lies within the maxillary sinus alone. In other types of case treatment is more appropriately and effectively managed by the rhinologist, alone or jointly with the oral surgeon.

In the cases of restricted disease of dental origin it can safely be anticipated that by eradicating the oral or dental factors and the pathologic conditions from within the sinus permanent cure will be effected. However, prognostication should always be made with a degree of reserve, as a sinus which was diseased and has been operated on is more prone to infection and complications than is a normal one. With the impairment or destruction of the ciliated epithelium which normally surmounts the lining membrane the tendency to infection is increased.

For this reason the apparently intact part of the lining membrane should be preserved. Even when damaged this tissue is capable of

repair and may regenerate to some extent. Such reconstructed tissue is more normal and more acceptable than is newly laid down repair tissue.

Foreign Bodies.—An oroantral fistula should never be closed without careful inspection and exploration of the cavity for foreign substances, which may find their way there from the oral cavity. That the irrigating solution is returned clear is not always reassuring in this respect. In 1 case two wads of chewing gum were found even though the fluid had been returned clear for some time.

The foreign body most commonly found is a tooth or a fragment of a tooth. It may be forced there in the removal of teeth or by external violence. An example is presented in figure 1, from the case of a boy of 14. He was struck with a baseball bat, and the partly formed third molar was driven into the sinus. A roentgenogram made in the case

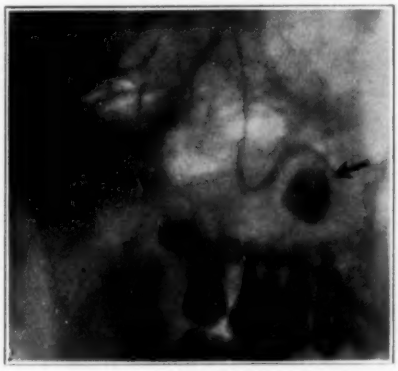

Fig. 1.—A partly developed third molar driven into the maxillary sinus with a baseball bat.

of a woman of 23 is presented in figure 2. She was having an impacted upper third molar removed under nitrogen monoxide and oxygen anesthesia, and the tooth was forced into the maxillary sinus.

A tooth or a portion of a tooth forced into the maxillary sinus should be promptly removed, as it always becomes and acts as an infective foreign body. Sometimes it is possible to remove such a tooth through an enlargement of the original opening. In both the cases cited the teeth were lodged at a distance which made them inaccessable, and it was necessary to make an opening at the base of the malar protuberance over the first molar and the bicuspid teeth.

A more common accident is the forcing of a fragment of root into the sinus. Such a fragment may remain close to the point of entrance, or it may be projected some distance from the opening. Removal through an enlargement of the original opening may be attempted if conditions are favorable. When it is successful, the soft tissues are approximated

in a favorable position for closure. With a clean sinus, such a result is all that is desired.

Drainage.—Until about a decade ago, it was an accepted practice, as in the Cooper operation, to establish drainage for empyema of the antrum through a tooth socket. The opening was maintained with a metal tube or hard rubber plug attached to the teeth or to a dental restoration. The sinus was often irrigated by the patient once or twice a day. Accidental openings were treated on the same principle.

The patients were fairly comfortable but were harassed through the years by the need of this awkward attention and by the constant fetid chronic suppuration. Their physical discomfort was aggravated by embarrassment due to the miasmatic emanation which penetrated to those in their proximity. Today this procedure is obsolete and probably rightly abandoned.

Fig. 2.—A third molar forced into the maxillary sinus in an attempt at removal.

The question arises: How soon should a sinus be closed by operation? One cannot be dogmatic or specific on the subject. If a sinus fails to close within three or four weeks, experience has shown that it is not likely to do so without an operation. With epithelization of the opening or progression of healing beyond the stage of granulation, the cicatrix becomes fixed. The aperture may become smaller, but complete closure does not take place (fig. 3).

Before one closes the opening, the obvious suppuration should be eliminated. The oral opening should be closed even when drainage into the sinus from another source may require treatment through the nasal route, as permanent cure cannot be obtained while communication between the mouth and the maxillary sinus exists.

CLOSING THE OROANTRAL OPENING

Closing of an oroantral opening is not always a simple or a successful procedure. Even recent literature indicates that the operation is often

performed without a definite plan and often ends in uncertainty as to complete closure. This was my experience until the technic here presented was developed in full detail. If the steps of the operation are carefully observed, a good result is practically always obtained.

The procedure may best be described as a *"sliding flap operation."* The following underlying principles must be closely observed:

1. The flap should have a broad base to insure a liberal supply of blood and so minimize the chances of sloughing or necrotization.

2. The flap must be freely mobilized to prevent tension.

3. The edges to be apposed should be pared so that all epithelized surfaces, tissue of poor texture and cicatricial tissue are removed.

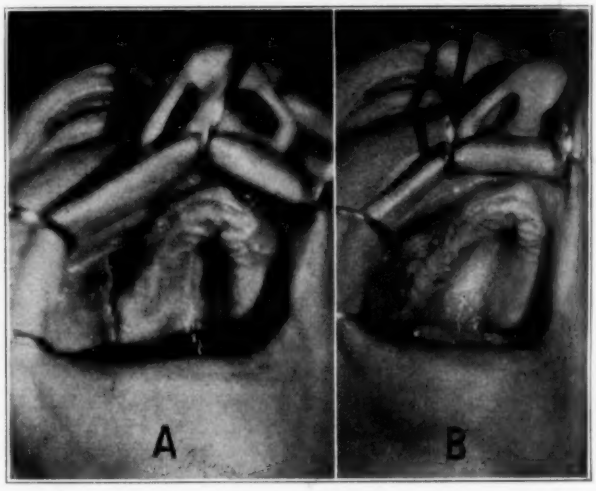

Fig. 3.—*A*, an opening into the maxillary sinus of about two years' duration. Cicatrization is complete, and the surfaces are epithelized. Actual cauterization or the application of escharotics will not induce or effect closure. *B*, the opening closed.

4. All the original tissue and cicatricial tissue of good texture, of which there is never too much, should be preserved.

5. Angulation caused by a sharp crest of bone may interfere with circulation. It is to be remembered that a flap which fits loosely at the time of the operation may become taut with postoperative edema during the first twenty-four or forty-eight hours and later through cicatricial contraction.

6. Clearly viable surfaces should be accurately apposed and coapted. Interposition of an epithelized surface or gaping of the wound at a point which is not supported by bone will prevent union.

7. Traumatization and maceration of the tissue should be avoided, especially at the edges, where primary union must take place.

8. Sutures should be placed which will maintain the relation of the tissue until union has taken place.

Preparation of the Flap.—An opening which followed the removal of a second molar is shown photographically in figure 4. The first step

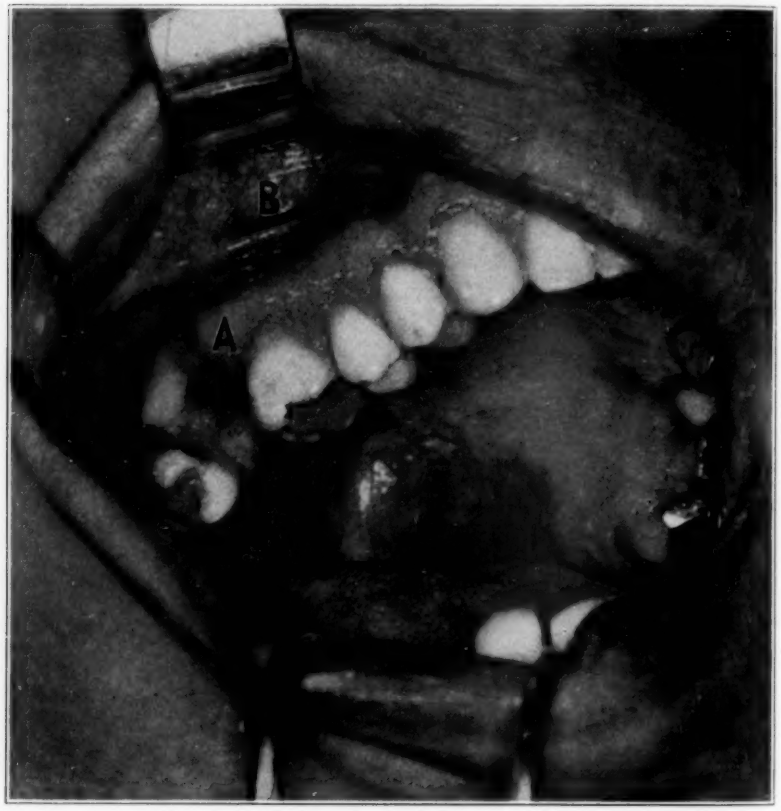

Fig. 4.—An opening into the maxillary sinus of six weeks' duration which followed the removal of a second molar. The edges of the mucous membrane are turned in. The gum tissue at *A* is inelastic and strongly adherent to the bone. The folds of mucous membrane at *B* are flexible and elastic. These folds of tissue can be displaced to advantage only after the periosteum has been released.

in closure is the excision of the tissues which form the lip of the orifice (fig. 5 *A*). From the extreme edges diagonal incisions are made through the mucoperiosteum to the bone (fig. 5 *B*). These incisions should be divergent enough to maintain an abundant supply of blood and yet permit of the flexibility necessary in displacing the flap. When the bony opening is large or is enlarged in the operation, the edges of a

broad-based flap will be better supported by the bone. This is an important detail, as incomplete closure is often due to the fact that too large an area of the flap is unsupported. In these cases, if primary union fails the edges of the wound become separated or are curled by cicatricial contraction.

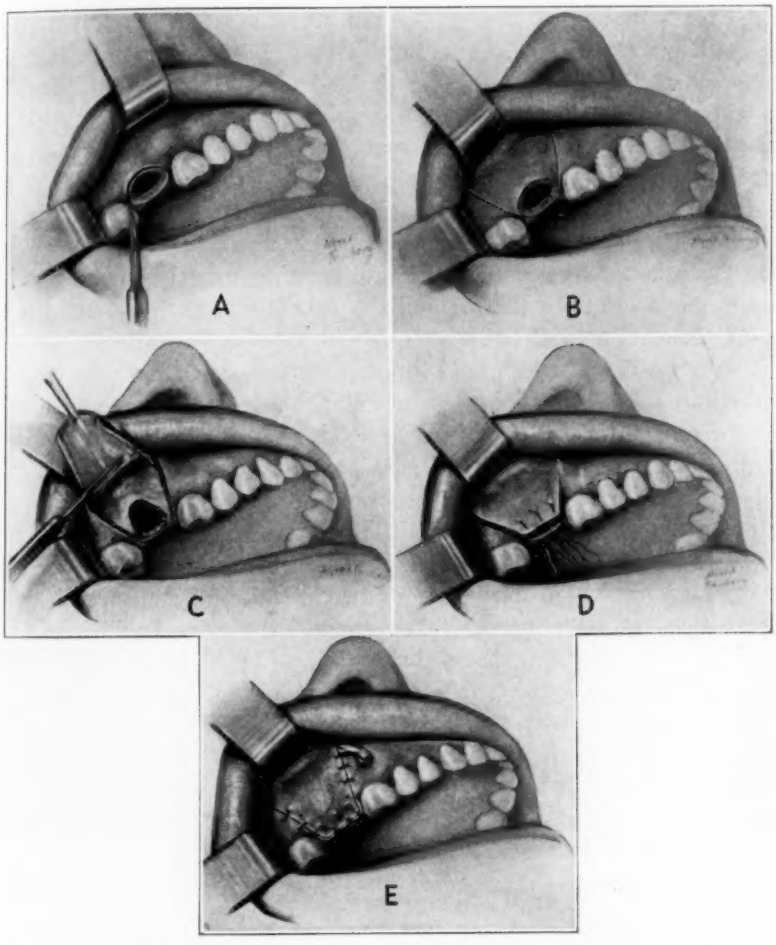

Fig. 5.—*A*, first step in the operation. The edge of the opening is excised, and a vivified surface is secured. *B*, two divergent incisions are carried from the extreme edges of the opening into the folds of tissue shown at *B* in figure 4. *C*, the flap is raised and the bony opening made large enough for inspection and for the removal of the diseased contents of the sinus. Several horizontal incisions are made through the periosteum as indicated, with the scalpel. *D*, the flap is trimmed to meet the palatal edges of the opening, and mattress sutures are introduced over the area where bone is lacking to secure definite coaptation. *E*, the mattress sutures are reenforced, and closing is completed, with interrupted sutures. The end of the iodoform gauze is shown protruding from the uppermost part of the wound.

It will be noted that even though the flap raised appears to be ample, it is not possible to appose the edges of the wound. Examining the mucosa, one sees that the tissues over the periosteum present loose and elastic folds, as shown in figure 4 at *B*. If properly treated, these should permit the necessary displacement. Stretching is prevented, however, by the closely woven and inelastic periosteum. To make the necessary approximation possible, the periosteum must be released. This is done by severing the periosteum alone at different levels without penetrating deeply where the blood vessels are lodged (fig. 5 *C*). The thickness of the flap should be preserved at the points of incision in so far as is possible. The periosteum should not be released at points too close to each other or too near the edges of the flap. Here the terminal vessels are nearer to the surface, and encroachment may lead to impairment of the supply of blood, sloughing and necrotization. When the periosteum is thus released, moderate traction may be exerted at the points of incision until the flap is loosened, so that the edges of the tissue do not merely meet but overlap.

The edges are further pared if necessary for accurate approximation. Epithelized surfaces and poorly vascularized repair tissue which meet over the opening are removed, as here one depends entirely on primary union. If it fails, closure will almost always be incomplete.

Little comfort is to be derived from the fact that a secondary opening is so small that it barely permits the passage of a fine probe. However small the opening, oral secretions, bacteria and food will pass through, and constant irritation and reinfection usually result. The parts which are remote from this vulnerable point and which are sustained by the underlying bone always close. In fact, it would be difficult to maintain an opening in such parts or higher in the vestibule.

The next important step is accurate suturing. Apposition of the viable surfaces is secured with mattress sutures in the area overlying the opening, as shown in figure 5 *D*. The mattress sutures should be reenforced with interrupted ones. The rest of the wound is closed with interrupted sutures (fig. 5 *E*).

Postoperative Care.—There are several views on the subject of dressing and postoperative care in these cases. Some favor permitting the sinus to close by primary intention without further care. Others provide drainage, as in the Caldwell-Luc operation, through a puncture in the nasal wall.

It is my practice to introduce 12 to 15 inches (30 to 38 cm.) of ½ inch (1.27 cm.) 5 per cent iodoform gauze into the uppermost part of the buccal fold between the last suture and the termination of the incision. The gauze is matted down on the floor of the cavity where most of the bleeding occurs, but no attempt is made to pack the sinus. In experience, immediate complete closure is not always good practice. It is desirable

to remove by lavage the postoperative blood clot, which frequently breaks down and becomes infected. Furthermore, during a period of the healing process there is the cicatricial ooze always pronounced in granulating larger bony surfaces, which is likewise subject to stagnation and infection. In several cases in which no provision was made for postoperative care, infection followed and a nasal puncture had to be made to get rid of it.

The gauze is left undisturbed during the first forty-eight hours and is removed in parts in two or three days to prevent secondary hemorrhage. The sinus is lavaged during the first week or ten days with tepid physiologic solution of sodium chloride.

The soundness of this practice in the type of case here described is confirmed by the fact that secondary complications were noted in only a few cases. The nasoantral wall was always left intact. Preserving this normal state probably contributed to the success. This procedure may not apply equally well when complications are present in the nose or the other accessory sinuses.

SUMMARY AND CONCLUSIONS

An oroantral fistula may become established because of the following conditions:

1. In the removal of a normal or an impacted tooth, because of the anatomic relation, without pathologic conditions.

2. Through operative inadvertence in the removal of teeth.

3. Through infections, cysts and neoplasms, which may destroy the intervening bone so that the sinus becomes involved.

4. Through traumatic injuries associated with fracture of the bony wall and a break in the continuity of the mucous membrane.

5. Through loss of bone following osteomyelitis and necrosis of the maxillary bone, with destruction of the soft tissues.

These openings lead to infection of the sinus and degeneration and destruction of the schneiderian membrane. They should be closed promptly, therefore after the obvious infection has been eliminated. Foreign bodies, such as teeth, fragments of teeth or other substances which may find their way into the cavity, should first be removed.

The advantages of the "sliding flap" operation here described are as follows:

1. The palatal tissues remain intact, with an undisturbed surface relation and blood supply.

2. No bony surface remains exposed to be filled in and covered with granulation tissue.

3. When the tissues are properly approximated and sutured, union takes place by primary intention, except at points intentionally kept open for drainage and irrigation.

4. The buccal flap is merely an extension of tissue normal to the parts.

5. In the course of time, surface adaptation occurs which is more like that of the alveolar ridges in outline. (While this is not important from the surgical standpoint, it is desirable for later dental prosthetic restorations.)

6. The fact that the floor of the antrum after healing may be somewhat higher and nearer to the ostium than it was originally may be advantageous in the cleansing of the cavity.

10 East Seventy-Fourth Street.

CONSTITUTIONAL BACKGROUND OF INFECTION OF THE UPPER PART OF THE RESPIRATORY TRACT

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For many ages textbooks and physicians dealt scantily with infection in the upper part of the respiratory tract. Writers of textbooks invariably relegated it to a minor place. Most books on medicine began with another subject, as typhoid or perhaps pneumonia. Today this is quite changed. Infection of the upper part of the respiratory tract, its serious attending sequelae and its accompanying bodily reactions probably are dwelt on more adequately and investigated more attentively than at any time since the dawn of modern medicine. The problem is not new; it has been discussed and written about in many ages and many climes. Long before modern medicine was evolved it was present. Herodotus [1] said concerning the Egyptians in 425 B. C., "physicians swarmed all over Egypt and treated every disease as a local disorder," and "some," he said, "treated diseases of the eye and head only." He further stated that the people complained to the emperor that this should be changed and the physician made to treat the body as a whole.

In Burton's "The Anatomy of Melancholy," [2] written in 1620, reference is made to Heurinus, a Dutch physician and writer who lived in the middle of the sixteenth century, who, in searching for causes of diseases of the mind, ascribed one division "to excrements of the brain, catarrhs, sneezing, rheums and distillations of the body." Here are two widely divergent thoughts, one antedating the first century A. D.

I think it was about thirty years ago that an eminent American bacteriologist enunciated his theory of focal infection and the relation of bodily diseases to pathologic changes in, and infection of, the head. I believe he created a great deal of discussion.

In 1915 Billings,[3] a Chicago physician and author, delivered ten consecutive lectures on focal infection at Stanford University. Almost

Read at a meeting of the Philadelphia Laryngological Society, May 2, 1938.

1. Herodotus: History, translated by G. Rawlinson, New York, Tudor Publishing Co., 1932, p. 108.

2. Burton, R.: The Anatomy of Melancholy, ed. 6 (1651), translated by F. Dell and P. Joran-Smith, New York, Farrar and Rhinehart, Inc., 1929.

3. Billings, F.: Focal Infection: The Lane Medical Lectures, New York, D. Appleton and Company, 1916.

every one has attacked the problem from the point of view of focal involvement. My object in this paper is to combat the thesis underlying such an attack.

It is an old observation that certain persons suffer much more frequently from infections of the upper part of the respiratory tract than others. If one considers the whole population of a certain area, exposed to the same or similar environmental factors and exogenous agents, such as infections, the fact that only a certain portion of the population is affected by infections of parts of the upper respiratory passages seems to indicate that endogenous constitutional factors play a role in the pathogenesis of such infections.

In any study of the role of the constitution in the genesis of a disease it seems necessary not only to demonstrate the importance of this factor by statistical methods but to analyze the mechanism by which the abnormal constitution causes susceptibility to a certain disease.

Without the possibility of resorting to laboratory methods of research or the facilities for experimentation on animals, such as cats, guinea pigs and mice, one has to approach this subject from an empiric standpoint. Scientific proof or formulas must give way to observation, and one must proceed empirically and clinically. Therefore, the confirmation of my hypothesis will be based on observation of a large number of patients, both institutional and private.

A number of authorities have found constitutional dyscrasia the governing factor in infections of the upper part of the respiratory tract. Bauer and Stein [4] found that infections of the middle ear occur in certain families with peculiar hereditary taints, pursuing an unusually protracted course, and in a great many instances observed an abnormal structure of the eustachian tube or the middle ear.

Wittmaack [5] noticed differences in the development of pneumatic cells of the temporal bone and also anatomic and histologic differences in the structure of the mucous membrane.

Schaeffer [6] stated that many reflex and referred nasal manifestations that occur in nasal disease can be accounted for by the anatomic arrangements and relations of neurons composing neuron circuits.

Kutepow [7] found otitis media in many patients of the lymphatic and asthenic constitutional type.

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4. Bauer, J., and Stein, C.: Konstitutionspathologie in der Ohrenheilkunde, Berlin, Julius Springer, 1926, p. 82.

5. Wittmaack, K., in Henke, F., and Lubarsch, O.: Handbuch der speciellen pathologischen Anatomie und Histologie, Berlin, Julius Springer, 1926, vol. 12.

6. Schaeffer, J. P.: The Nose, Paranasal Sinuses, Nasolacrimal Passageways, and Olfactory Organ in Man, Philadelphia, P. Blakiston's Son & Co., 1920, p. 294.

7. Kutepow, J. P.: Ueber die Bedeutung des Konstitutionsmoments in der Pathogenese der Ohrenkrankungen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **9**:497, 1925.

Spira [8] observed that patients with other degenerative conditions, such as lymphatic hypertrophy and endogenous diseases, are more often afflicted with disease of the upper part of the respiratory tract than are those of any other type.

Siemens [9] and Weitz [9a] found peculiar reactions of the mucous membrane in patients with lymphatic hyperplasia.

Bauer and Stein [10] stated that it is most important to examine the noses and throats of those who have any constitutional anomaly.

In 1925 Kutepow [11] compiled observations on infections of the head. Of 47 patients, 43 were distinctly of the lymphatic and asthenic constitutional type, and little if any progress was made in treating them.

Jarvis [12] reported observations and statistics collected by "fifty nationally known medical men." He said that the "mucous membranes of the upper respiratory tract present different colors in the sympathetic and the parasympathetic type, which gives one an indication of the constitutional type of the patient with whom one is dealing." In a private communication (1936) he stated that the problem is basically one of oxygen metabolism, in which bodily catalysts or activators play the most important part in building and rebuilding bodily cells. He stated that "disease begins when cells do not get a proper quality or quantity of food and oxygen; thus, the factors constituting the fundamental life of the cell being interfered with, departure from the normal chemical constitution of the body begins." He concluded that the problem in disease of the upper part of the respiratory tract is not one of infection but one of oxygen metabolism.

Draper [13] complained against the habit of clinging to mechanistic tradition in treating sinus disease in relation to its etiology.

Fenton [14] said, "Influences of a general order with definitely lower resistance in susceptible persons . . . especially . . . chilling of the body

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8. Spira, R.: Ueber Heredität bei Ohrenkrankheiten, Monatschr. f. Ohrenh. **48**:354, 1914.

9. Siemens, H. W.: Die Zwillingspathologie, ihre Bedeutung, ihre Methodik, ihre bisherigen Ergebnisse, Berlin, Julius Springer, 1924.

9a. Weitz, cited by Siemens,[9] p. 101.

10. Bauer and Stein,[4] p. 108.

11. Kutepow, cited by Bauer and Stein,[4] p. 90.

12. Jarvis, D. C.: Changes in the Color of the Intranasal Mucous Membrane as a Guide to the Status of the Sympathetic and of the Parasympathetic System, Arch. Otolaryng. **21**:131 (Feb.) 1935.

13. Draper, G.: Human Constitution: A Consideration of Its Relationship to Disease, Philadelphia, W. B. Saunders Company, 1924.

14. Fenton, R. A.: Non-Infectious Factors in the Etiology of Sinus Disease, with Special Reference to the Reticulo-Endothelial System, Tr. Am. Laryng., Rhin. & Otol. Soc. **36**:128, 1930.

surface," with particular reference to the reticuloendothelium, may play a large part in the process of infection of the upper part of the respiratory tract.

In the discussion following Fenton's [14] paper, Lee M. Hurd said, "Sinus trouble does not start from a bacterial focus. I think it is allergic. There is also a vitamin influence."

Ruskin said, "The autonomic nervous system in the nose is related to the reticuloendothelial system; this probably reacts on the autonomic system, causing vasomotor changes in the nose."

Lewy, of Chicago, said, "Study of the underlying constitutional factors in disease is making itself felt in all branches of medicine."

Fenton and Larsell,[15] of the University of Oregon Medical School, Portland, in 1931 reported research work which indicated the importance of the production of histiocytes and their relation to the reticuloendothelial system in the nasal mucosa in the defense mechanism against infection of the upper part of the respiratory tract.

In order to study the influence of constitutional factors in infections of the upper part of the respiratory tract, two groups of subjects were examined.

One of these groups was selected from 754 male and female students at a college (Ursinus College, Collegeville, Pa.) and was composed of young men and women who came from good, solid, substantial, middle class families, representing the average, normal type. The other group was a cross section of the inmates of an institution which contains persons, both male and female, of degenerative types (Pennhurst State School, Pennhurst, Pa.). Members of both these groups live in the same vicinity, the institutions being within 10 miles (16 kilometers) of each other. The tabulations are intended to give light on the constitutional backgrounds of persons of both groups and the percentage suffering from infective disease of the upper part of the respiratory tract. It is obvious that subjects of the degenerative type are more affected by the constitutional factors in their basic background than are those of the other type, who are slightly affected. The first tabulation represents data on students of Ursinus College over two years. The diagnosis was made from the history and from clinical examination by me. In this series, it will be noticed, there are 23 patients with a history of a definite infection; 18 of the 23 offered no information of interest aside from a history of such diseases as pneumonia, heart disease and common diagnostic entities. However, 5 had a definite history of tuberculosis in the parents.

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15. Fenton, R. A., and Larsell, O.: Some Experimental and Clinical Observations on "Reticulo-Endothelial" Components of Accessory Sinus Mucosa, Tr. Am. Acad. Ophth. **36**:225, 1931.

Subject	Family History	Personal History
J. A.	No contributory data	Infection of posterior ethmoid sinus
C. B.	No contributory data	Ethmoiditis
I. K.	No contributory data	Infection of ethmoid sinuses
A. M.	No contributory data	Bilateral infection of ethmoid sinuses
F. M.	No contributory data	Infection of ethmoid sinuses
F. S.	Tuberculosis	Chronic infection of ethmoid sinuses
F. T.	No contributory data	Bilateral infection of ethmoid sinuses
R. Y.	Tuberculosis	Chronic ethmoid and maxillary sinusitis on left
I. B.	No contributory data	Infection of maxillary and ethmoid sinuses
F. B.	Tuberculosis	Purulent infection of maxillary and ethmoid sinuses on right side
V. J.	No contributory data	Infection of ethmoid sinuses
N. P.	No contributory data	Infection of ethmoid sinuses
H. S.	No contributory data	Infection of ethmoid sinuses
R. M.	Tuberculosis	Infection of ethmoid and maxillary sinuses; old infection of ear
N. D.	No contributory data	Mastoiditis at 3 years
E. F.	No contributory data	Chronic otitis media
S. K.	No contributory data	Mastoiditis at 10 years
A. L.	No contributory data	Chronic otitis media
R. M.	No contributory data	Mastoiditis at 15 years
N. L.	No contributory data	Mastoiditis at 7 years
L. W.	Tuberculosis	Mastoiditis at 9 years
J. C.	No contributory data	Otitis media
R. W.	No contributory data	Chronic otitis media

In the second tabulation are data on 42 patients selected from 100—a cross section of the inmates of an institution for persons of definite constitutional types involving degenerative and acquired conditions in the familial background, the Pennhurst State School at Pennhurst, Pa.

Subject	Family History	Personal History
R. D.	Mother died of tuberculosis; siblings feebleminded	Numerous infections in upper part of respiratory tract; bilateral otitis media; bilateral mastoidectomy; mastoid tip on right side, not removed, causing moderate discharge
V. M.	Father murdered mother	Epilepsy; numerous infections of upper part of respiratory tract; chronic otitis media
J. D.	Father alcoholic, died of tuberculosis; mother psychotic and alcoholic	Bilateral otitis media with more severe involvement on left side
C. R.	Father nervous but otherwise in good health; mother well	Epilepsy; chronic bilateral otitis media; numerous infections of upper part of respiratory tract; enlarged infected tonsils
L. T.	Siblings feebleminded	Chronic otitis media on right side; infected tonsils
C. G.	Mother and siblings feebleminded	Chronic otitis media; infections of upper part of respiratory tract
F. W.	Father low grade; he and one of his brothers deaf; mother of low morality; siblings feebleminded	Infected tonsils and adenoids; many infections of upper part of respiratory tract; otitis media; secondary infection of lungs due to postnasal drip
A. K.	Father healthy; mother defective	Numerous infections of upper part of respiratory tract; chronic otitis media
G. L.	Father healthy; mother feebleminded and syphilitic	Numerous infections of upper part of respiratory tract; infected tonsils and adenoids; chronic otitis media
W. M.	Siblings retarded	Infections of upper part of respiratory tract; cervical lymphadenitis; chronic otitis media
J. S.	Father alcoholic; mother feebleminded	Infections of upper part of respiratory tract; chronic otitis media
R. N.	Nothing known	Deviated nasal septum; chronic otitis media; infected tonsils
J. C.	Father feebleminded; mother had 8 stillborn children; 2 of 5 siblings apparently normal	Tonsillitis; infections of upper part of respiratory tract
R. H.	Father had dementia praecox, apparently arrested; mother feebleminded; 6 siblings, all feebleminded	Infections of upper part of respiratory tract; many attacks of tonsillitis
F. R.	Mother insane	Chronic mastoiditis; numerous infections of tonsils and adenoids; infections of upper part of respiratory tract
A. B.	Parents apparently normal	Whooping cough; epilepsy; prolapse of rectum; infections of upper part of respiratory tract; chronic infection of both ears

Subject	Family History	Personal History
M. W.	Father healthy; mother in poor health and said to be epileptic; 1 sibling probably mentally defective	Infections of upper part of respiratory tract; many attacks of tonsillitis
F. B.	Mother in insane asylum; 7 siblings, all feebleminded	Measles; whooping cough; numerous infections of upper part of respiratory tract
W. G.	One feebleminded sibling	Chronic otitis media; infection of upper part of respiratory tract
M. A.	Parents apparently normal	Pneumonia; measles; whooping cough; mumps; epilepsy; infection in upper part of respiratory tract; sinusitis; otitis media; infected tonsils
P. E.	Parents apparently normal	Measles; whooping cough; chickenpox; diphtheria; epilepsy; numerous infections of skin; chronic otitis media; infections of upper part of respiratory tract; defective tonsils
J. K.	Father in insane asylum; mother apparently normal	Whooping cough; syphilis; otitis media; tonsillitis; infections of upper part of respiratory tract
J. W.	Parents apparently normal	Mongolism; infections of upper part of respiratory tract; purulent rhinitis; sinusitis; otitis media
W. S.	Family of poor stock	Microcephalia; internal strabismus; infections of upper part of respiratory tract; tonsillitis
R. P.	Family apparently normal	Mongolism; infections of upper part of respiratory tract; sinusitis; mastoiditis
C. P.	Father alcoholic; mother apparently normal; siblings mentally defective	Measles; chickenpox; whooping cough; tonsillitis; infections of upper part of respiratory tract
R. A.	No history of mental deficiency in family	Infections of upper part of respiratory tract; chronic otitis media; neurologic disease
M. Z.	Some mental retardation in siblings	Pneumonia and measles; infections of upper part of respiratory tract
H. D.	Mother has tuberculosis	Hydrocephalus; chronic otitis media; infections of upper part of respiratory tract; infected tonsils and adenoids
C. P.	Father drunkard and suicide (subnormal); half brother mentally defective	Infections of upper part of respiratory tract; chronic otitis media; infected tonsils and adenoids
S. D.	Father alcoholic, died of tuberculosis; mother often an inmate of insane asylums	Infections of upper part of respiratory tract; chronic otits media and sinusitis
J. C.	Mother apparently subnormal; 5 subnormal siblings by her second husband	Pneumonia; infections of upper and lower parts of respiratory tract; chronic otitis media and sinusitis
E. K.	Father dead; mother apparently in good health	Unilateral otitis media; infected tonsils and adenoids
P. M.	Parents apparently normal	Epilepsy; chronic otitis media; infections of upper part of respiratory tract
T. B.	Father healthy, although nervous; mother apparently healthy; of 6 siblings 2 died of syphilis and 1 has club feet; paternal grandfather said to be an opium addict	Numerous infections of upper part of respiratory tract; chronic otitis media; infected tonsils
W. O'B.	Father alcoholic; 5 feebleminded siblings; mother apparently healthy	Infections of upper part of respiratory tract; infected tonsils and adenoids; chronic otitis media
W. B.	No contributory data except that father had a nervous breakdown	Chronic otitis media; infected tonsils and adenoids; imbecility
C. W.	Two of 8 children stillborn; 1 died of empyema	Convulsions during teething; usual diseases of childhood; convulsions about once a month at age of 17; many infections of upper part of respiratory tract; 2 mastoidectomies; imbecility
R. W.	Mother supposed to be feebleminded; 15 siblings, 8 of whom died	Measles; mumps; whooping cough; congenital feeblemindedness; epilepsy; positive Wassermann reaction; many infections of upper part of respiratory tract; maxillary sinusitis; infection of ethmoid sinuses; chronic osteomyelitis; imbecility
A. B.	Father died of chronic alcoholism; mother died of tuberculosis	Chronically discharging ears; infections of upper part of respiratory tract; numerous carious teeth; ethmoiditis; moronity
L. S.	Father died of cancer; mother apparently healthy	Maxillary and ethmoid sinusitis; numerous infections of upper part of respiratory tract
G. M.	Father committed suicide; 7 siblings, all cared for in institutions and all retarded	Measles; whooping cough; infections of upper part of respiratory tract; postnasal infection; infected tonsils and adenoids

The third tabulation consists of data on 7 patients selected from a private practice and the Montgomery Hospital, Norristown, Pa.

Subject	Summary of Case
A. M.	Twelve years of age; atrophic rhinitis; bilateral purulent mastoiditis
B. A.	Eight years of age; atrophic rhinitis; bilateral purulent mastoiditis
F. B.	Female; 24 years of age; purulent pansinusitis (father died of acute toxic dementia following purulent pansinusitis with generalized infection of upper part of respiratory tract, including both tonsils and teeth; brother also had purulent mastoiditis)
M. F.	Female; 5 years of age; asthma; bronchitis; repeated infections of upper part of respiratory tract; ethmoiditis (father a heavy drinker; mother died of tuberculosis)
F. F.	Thirty-two years of age; definite bronchial asthma; bronchitis; chronic hyperplasia of nose and throat including tonsils (diabetes in 2 members of family)
F. Y.	Seventeen years of age; purulent bilateral ethmoiditis; no illness until 16 years of age; 4 plus reaction to Wassermann test, acquired within one year of onset of sinus infection (poor, illiterate parents)
G. H	Thirty-four years of age; asthma; bronchitis; pansinusitis; bilateral maxillary and ethmoid sinusitis; infection of left middle ear; abscess of lung

Each one of these patients had hyperplasia of the entire upper part of the respiratory tract. They had one thing in common, overgrowth of tissue within the mucosal area of this region. This is associated frequently with imbalance of the autonomic system. The following characteristics in the 7 patients were noticed: familial background of some constitutional or endogenous disease, tuberculosis, diabetes, chronic alcoholism or syphilis, and highly colored (red or dark red), thick mucous membranes with poor neurogenic response. They all seemed to have autonomic imbalance, and they all had similar diseases and symptoms.

In the mechanism of infection or disease of the upper part of the respiratory tract several factors may play a role. For example, endocrines inducing abnormal metabolism of cells in various organs, with insufficient utilization of substances necessary for normal bodily metabolism, may be important. Certain neurogenic factors causing abnormal reactions, particularly within the vascular system, with lack of normal reflex response in the mucous membrane, may be the determining cause. For example, if there is insufficient reflex vascular response in the mucous membrane, there will be a lowered constitutional state, which gives insufficient protection to the subject and exposes him to many types of localized infection. The last-mentioned factor may easily be studied by determining the reaction of the vessels to stimuli, both mechanical and biologic. To this end dermographism in groups of patients was studied, because it is well established that the dermographic response varies according to vasomotor stability. A study of the relations of the two groups was made.

Two tabulations are appended concerning the dermographic tests in the first and the second group. The first, normal, group was tested on Jan. 3, 1939.

Subject	Time of Rise, Sec.	Width, Mm.	Duration (to Fading), Min.
E.....	3	2.5	2
K.....	2	3.0	2.5
H.....	3	3.5	3.5
G.....	6	4.0	3.5
F.....	10	2.75	3.0
N.....	6	3.50	3.5
E.....	8	4.00	3.85
W.....	5	3.5	4.25
G.....	11	3.0	8.6
E.....	10	4.25	4.5
P.....	3.5	2.10	2.0
W.....	6.0	4.00	3.00
P.....	8.0	3.75	4.00
W.....	7.0	3.00	4.00
H.....	6.00	6.50	5.50

The second group, composed of subjects of abnormal types, was tested on July 25, 1938. The subjects were tested by making dermographic lines on the chest.

Subject	Time of Rise, Sec.	Width, Mm.	Duration (to Fading), Min.
A. K.	5	6	12
F. W.	5	4	8
L. T.	5	6	12
G. L.	5	4	7
A. D.	5	5	10
L. S.	5	7	9½
P. M.	4	8	Over 30
C. R.	4	7	Over 30
A. B.	4	4	4
R. W.	4	8	Over 30
J. D.	4	12	Over 30
H. W.	10	3	13
C. W.	5	3	6½
S. D.	5	12	10
F. R.	5	10	12

In the study of dermographism the inmates of the Pennhurst institution, group 2, showed extreme abnormality and an extremely high percentage of pathologic reactions, marked by edema and long persistence of the vascular response of the skin (up to thirty minutes or more). In the other group, from Ursinus College (group 1), the dermographic response was practically of no significance, showing little vascular reaction to mechanical stimulation. It should, however, be emphasized that anomalies of the vasomotor apparatus may be only one of the constitutional factors; further study may reveal many others. Empirically it would appear that patients who show lymphatic hyperplasia with dysfunction of the vegetative system and abnormal vascular and neurogenic responses have not only bad constitutional backgrounds but some form of endogenous constitutional dyscrasia. Of these patients, a consistently high percentage have chronic infection of the upper part of the respiratory tract.

The students of the first group made little if any response to the dermographic tests and the appearance of the mark and the length of time that it remained on the skin were of little significance. Aside from the clinical and empiric observations made with these tests a practical observation also was recorded. In 5 of the subjects in the second group, on whom surgical work aside from tonsillectomy had been done, it was noticed that the end result was poor and the healing delayed. It appears that this procedure might give a good indication of the prognosis for surgical work on patients with low vasomotor stability and poor neurogenic response when purulent infection of the upper part of the respiratory tract is present. In other words, the prognosis for this type of patient may vary with the intensity of the dermographic reaction.

COMMENT

With regard to treatment, little is accomplished unless one can definitely change the constitutional factors in the case. Naturally, when the basic background of the patient is at fault the problem is almost hopeless. However, certain therapeutic measures seem to offer a good deal of benefit. For example, in the field of allergy sometimes a small change in the diet gives great relief of the patient's symptoms. In 1 case, in which a child was drinking a quart of milk a day, the elimination of this food brought about a cessation of the disturbance in the upper part of the respiratory tract; the turbinates became smaller and less edematous, and the cough, undoubtedly an allergic phenomenon, disappeared. In another case, of asthma with bronchitis, 3 minims (0.18 cc.) of insulin effected a complete change, undoubtedly because insulin is a hormone to the parasympathetic mechanism and since it apparently regulated the imbalance in the involuntary mechanism it restored the basic equilibrium of the body. It should be remembered also that mild stimulation of the sympathetic nervous system will stimulate the thyroid and correct the lowering of physiologic metabolism incident to endocrine disturbance. This often results in physiologic balance, and symptomatic relief is experienced. Older physicians knew of and spoke about "alteratives." I believe there was truth in their view. Certainly the substances appear to do some good.

Recently potassium chloride in 5 grain (0.32 Gm.) doses has been tried with a view to changing the basic bodily reactions. For patients of certain types, it will no doubt do good. The end result to accomplish is physiologic equilibrium. If the autonomic system, the endocrine system or the acid-base metabolism is at fault, one must diagnose the condition and attempt to regulate it physiologically.

SUMMARY

The incidence of infection of the upper part of the respiratory tract in two constitutionally different groups of persons was studied.

Group 1 included average, normally healthy college students.

Group 2 included a cross section of the inmates of a school for persons of low grade mentality.

In addition, a number of private patients were studied.

The difference in the incidence of infection of the upper part of the respiratory tract in the two groups strikingly indicates the variation of the constitutional factor.

In an analysis of this factor, the vasomotor reactions in the two groups were compared by studying the dermographic response.

The dermographic reaction was much more marked and definite in group 2.

It is pointed out that abnormal vasomotor reactions may play an important part in the mechanism of infection of the upper part of the respiratory tract.

NOTE.—Dr. McClellan Wilson, of Pennhurst State School, and Dr. J. Harold Brownback, of Ursinus College, helped with the collection of data and with the dermographic studies of the students from their respective institutions.

THE LARYNX OF THE TUBERCULOUS CHILD

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Tuberculosis affecting the larynx of children is not frequently considered. This is so because pulmonary tuberculosis is infrequent in children. Tuberculosis of the larynx of a child is usually discovered during routine examination because the symptoms are frequently not pronounced.

As early as 1806 Laignelet [1] reported the case of a child 12 years of age. Thirty years later Trousseau and Belloc [2] reported 2 cases and called attention to the rarity of tuberculosis of the larynx before puberty. The statistics of many investigators verify the rarity of this condition. Only 1 of 500 tuberculous larynges examined by Mackenzie [3] was that of a child. Of 100 tuberculous patients on whom autopsy was performed, 5 were under 15 years of age. Demme [4] reported laryngeal involvement in 7 children in 1883. In the same year Froebelius [5] reported on a series of 16,581 autopsies on children during a ten year period. There were 416 with pulmonary tuberculosis and of these, 10 had ulceration of the larynx. Heinze [6] found 5 cases of laryngeal involvement in children under 10 years of age in 1,226 autopsies. One child was less than 1 year old. Blumenfeld and Goebel [7] examined the

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From the Otolaryngologic Service of Dr. M. C. Myerson, Sea View Hospital, Staten Island, N. Y.

1. Laignelet, L. F.: Recherches sur la phthisie laryngée, Thesis, Paris, no. 38, vol. 61, 1806.

2. Trousseau, A., and Belloc, H.: Traité pratique de la phthisie laryngée, Paris, J. B. Baillière, 1837, observation XL, p. 100; observation LIX, p. 150.

3. Mackenzie, M.: Traité pratique des maladies du larynx, du pharynx et de la trachée, translated by E. J. Moure and F. Bertier, Paris, O. Doin, 1882.

4. Demme, cited by Perrin.[18]

5. Froebelius, W.: Ueber die Häufigkeit der Tuberculosis und die hauptsächlichen Localisationen im zartesten Kindesalter, Jahrb. f. Kinderh. **24**:47, 1886.

6. Heinze, O.: Die Kehlkopfsschwindsucht, Leipzig, Veit u. Comp., 1879.

7. Blumenfeld, F., and Goebel, W.: Ueber die Kehlkopfschwindsucht bei Kindern, Ztschr. f. Laryng., Rhin., Otol. **23**:267, 1932.

larynges of 89 children suffering with pulmonary tuberculosis. They found 34.8 per cent to be normal. There were questionable lesions in 31.5 per cent and frank ulcerative lesions in 33.7 per cent. These figures are open to question because they are at variance with those of many experienced workers in this field. Lipovetskaya [8] found laryngeal tuberculosis in 2 of 60 children with the open type of tuberculosis.

At the present time we have 115 children in the pediatric service at the Sea View Hospital. One hundred were examined, and 49 of these had laryngeal changes. Of these 49, 30 had tubercle bacilli in their sputum, or feces or gastric contents.

The patient in the case reported by Nobécourt and Tixier [9] in 1909 is the youngest one on record, an infant 3½ months old. On postmortem examination the larynx was found to contain granulation tissue and ulcerations.

Various reasons are given for the relative infrequency of this condition. Murano [10] expressed the belief that the lymphatic ring of Waldeyer exerts a protective influence. Barthez and Sanné [11] stated that the symptoms are not noticed early because of their mildness. Later, in the majority of cases they are overshadowed by the general complaints, which appear to be more important. Hoarseness and dysphagia may appear just before death. In this connection Myerson [12] called attention to the fact that there is frequently a hematogenous spread of the disease to the larynx and other viscera shortly before death. For this reason postmortem observations in the larynx are not always reliable or dependable. Barthez and Sanné [11] mentioned that the child's larynx is not exposed to abuses which frequently cause chronic laryngitis such as alcohol, tobacco and dust, as in the occupations.

The method of production of the laryngeal infection is discussed by many authors. Louis [13] was first to ascribe infection of the larynx to the sputum. Similar observations were made by Gouguenheim and

8. Lipovetskaya, E. N.: Laryngeal and Pharyngeal Tuberculosis in Children, Probl. tuberk., 1936, pp. 1569-1570.

9. Nobécourt, P., and Tixier, L.: Tuberculose du larynx chez un enfant de 3½ mois, Bull. Soc. de pédiat. de Paris **11**:368, 1909.

10. Murano, G.: Su due casi di tubercolosi laringea, Pediatria **43**:1254, 1935.

11. Rilliet, F., and Barthez, E.: Traité clinique et pratique des maladies des enfants, ed. 3, revised by E. Barthez and A. Sanné, Paris, F. Alcan, 1891.

12. Myerson, M. C.: Tuberculosis of the Larynx, Quart. Bull., Sea View Hosp. **4**:127, 1938.

13. Louis, P. C. A.: Recherches anatomico-pathologiques sur la phthisie, Paris, Gabon & Cie, 1825.

Tissier,[14] Fraenkel [15] and others. Infections by way of the blood vessels and lymphatics were first described by Isambert [16] in 1874. Catti [17] and others also expressed the opinion that infections occur in this manner. Direct invasion of the laryngeal mucosa by the organisms carried in inspired dust was mentioned by Perrin [18] as the causative factor in his case.

The methods of infection may be listed in their order of frequency as follows: (1) by way of the lymphatics from the primary pulmonary lesion, (2) by direct contact with the bacilli-laden sputum, (3) through the blood stream, as in miliary infections, and (4) by direct extension from a primary pharyngeal lesion.

The pathologic process of tuberculosis has recently been discussed by Myerson.[12]

None of our patients had a laryngeal lesion at the same time as the primary complex.

The possibility of infection of the larynx from tuberculosis of the tonsils and adenoids must be considered.

In several of our patients in whom the pulmonary lesion was either of the arrested or of the glandular type the tonsils and adenoids were removed and on section proved to be tuberculous. Infection occurring through the lymphatics or submucosal tissue must be considered. It is well known that streptococcic infections of the larynx are not infrequently secondary to tonsillar or peritonsillar inflammation and are due to direct extension.

Laryngeal involvement occurs more often with the caseous pneumonic type of pulmonary tuberculosis than with any other type of lesion. Since the sputum is positive more often in this than in any of the other types of infection, involvement of the larynx by direct contact with infected sputum must be considered as the most frequent mechanism of infection.

SYMPTOMATOLOGY

We were impressed by the lack of symptoms in many of the children examined by us. Some were so mild that one would hardly expect to

14. Gouguenheim, A., and Tissier, P.: Phthisie laryngée, Paris, G. Masson, 1889.

15. Fraenkel, E.: Untersuchungen über die Aetiologie der Kehlkopfgeschwüre, Virchows Arch. f. path. Anat. **121**:523, 1890.

16. Isambert: De la tuberculose miliare aiguë pharyngo-laryngée phthisie aiguë pharyngo-laryngée, read before la Société médicale des hôpitaux de Paris, April 10, 1874; Conférence clinique sur les maladies du larynx et des premières voies, Paris, G. Masson, 1877.

17. Catti, G.: Der pharyngo-laryngeale Typhus der acuten Miliartuberkulose, Wien. klin. Wchnschr. **7**:438, 1894.

18. Perrin, M.: La tuberculose du larynx dans l'enfance, Rev. hebd. de laryng. **1**:65 and 338, 1902.

find definite or extensive changes in the larynx. The symptoms varied from a slight huskiness to hoarseness and aphonia. A sense of soreness in the throat and a slight dysphagia were occasionally complained of. None of the severe symptoms usually seen in the adult larynx were found.

EXAMINATION

We were able to make all of the examinations by the indirect laryngoscopic method. Ten children were not included in this series because we could not examine them with the mirror. Direct laryngoscopic examination was not employed for any of these children. The lesion most frequently seen is a redness or hyperemia. This may occur in any part of the larynx but is most frequently seen in the region of the arytenoid cartilage, the posterior commissure and the posterior half of the true cord. Infiltration of one or of both cords has occasionally been seen. Granulations, edema, ulceration and perichondritis are rarer findings. One of our patients who was examined at autopsy had extensive ulceration on the epiglottis and vocal cords. Necrosis of the cricoid cartilage has been described by Bar.[19] Infiltration of the area of the posterior commissure and of the ventricular bands has been seen several times. The rarest form is the acute miliary type first described by Isambert. The vocal cords of 2 of our patients were studded with fine pinpoint lesions. One patient had a positive Wassermann reaction and the other a positive Kahn reaction. Biopsy was not performed in either case. The possibility of such a lesion being a benign form of miliary lesion in the larynx must be considered.

Only 4 of the 100 tuberculous children were referred for a laryngologic examination because of persistent hoarseness or dysphagia. The remaining 96 were subjected to a routine examination of the larynx regardless of the presence or absence of symptoms.

The children were between 3 and 15 years of age. Forty-nine per cent of them presented some evidence of involvement of the larynx.

An analysis of the laryngeal lesions of these children revealed that the posterior commissure and the arytenoid cartilage were most frequently involved. The most common lesion was hyperemia, which was either localized to one of the structures or involved the entire larynx. The next most common lesion was infiltration. Other local manifestations of the disease in their order of frequency were ulceration, edema and tuberculoma.

Hyperemia of some part of the laryngeal mucosa is usually the earliest sign of laryngeal tuberculosis in children. Edema is occasionally seen as the first lesion. We have seen it more often in adults than in children. It is considered as an allergic manifestation to the bacillary proteins.

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19. Bar, L.: De la laryngite oedémateuse chez les enfants, Arch. internat. de laryng., d'otol., de rhin. **9**:354, 1896.

The distribution of the lesions in the 49 positive larynges was as follows:

		No. of Patients
1. Hyperemia of the entire larynx		7
2. Interarytenoid space	Hyperemia	15
	Infiltration	7
	Tuberculoma	1
	Ulceration	1
3. Arytenoid cartilages		
(*a*) Right	Edema	1
(*b*) Both	Hyperemia	6
	Infiltration	3
	Edema	3
4. Vocal cords		
(*a*) Right	Papilloma	1
	Miliary Tuberculosis	1
(*b*) Left	Ulceration	1
(*c*) Both	Hyperemia	8
	Infiltration	4
	Edema	1
	Ulceration	1
	Miliary Tuberculosis	1
5. Ventricular bands		
(*a*) Right	Ulceration	1
(*b*) Both	Edema	1
	Ulceration	1

In the group of patients with infiltrative pulmonary tuberculosis there were 7 with laryngeal changes, in 5 of whom they consisted of hyperemia. The sputum of all of the group with laryngeal changes was negative. One had a positive gastric content. The greater number with positive evidence of tubercle bacilli occurred in the group without laryngeal involvement. Of the 6 patients in this group, 1 had a positive sputum and 3 a positive gastric content.

Of the 22 with exudative pulmonary lesions, there were 8 with involved larynges. The sputum of all these children was negative and the gastric contents of 1 were positive; this child had a hyperemic lesion of the larynx. The findings for the remaining children in this group in regard to sputum, gastric contents and feces were negative.

Of the group of 43 with caseous pneumonic tuberculosis, 30 had laryngeal involvement. Of these, 18 had positive sputum, 5 had positive gastric contents and 2 had positive feces. The lesion in 17 of the patients consisted of hyperemia. Nine of these had positive sputum and 3 had

positive gastric contents. Tubercle bacilli in the sputum, gastric contents and feces seem to occur with the same frequency irrespective of whether the lesions are minimal or far advanced when the pulmonary tuberculosis is of the caseous pneumonic type.

Most of our children with exudative and infiltrative types of tuberculosis and a small percentage of the others had no tubercle bacilli in the sputum, gastric and fecal contents. A direct examination of the secretion from the lobe bronchus is frequently positive in these cases. This can be obtained by bronchoscopic examination, which might reveal a tracheobronchial lesion or the presence of considerable secretion coming from a lobe bronchus. A 14 year old white girl had a caseous pneumonic lesion of the upper lobe of her left lung. The sputum was persistently negative and the gastric content occasionally positive. After pneumothorax, the gastric content still remained positive. Bronchoscopic examination revealed a granular appearance of the trachea and

Incidence and Relation of Laryngeal Involvement to Pulmonary Involvement

Pulmonary Findings	Number of Patients	Number with Laryngeal Lesions	Hyperemia of Larynx	Other Lesions	Positive Sputum	Positive Gastric Contents	Positive Feces
Caseous pneumonia	43	30	17	13	30	7	3
Exudative	22	8	5	3	0	1	..
Infiltration	13	7	5	2	1	4	..
Mediastinal glands	12	0	0	0	0	0	0
Pleural effusion	10	4	1	3	0	0	0

the left main bronchus and the opening to the upper lobe of the left lung. A considerable amount of exudate came from this lobe. Direct examination of a smear showed a high number of tubercle bacilli on the basis of the Gaffky scale.

There were 54 children in whom the examination of the sputum, gastric contents and feces failed to show the presence of tubercle bacilli. Laryngeal changes were found in 23 (42 per cent). Their lesions were as follows: hyperemia, 14; edema, 4; thickening of the vocal cords, 3; infiltration of the posterior commissure, 1, and other lesions, 1.

Of the 46 children with positive findings for tubercle bacilli in the sputum, gastric contents or feces, 25 had laryngeal lesions (54 per cent). In this group there was a greater incidence of laryngeal involvement.

A pleural effusion associated with no other demonstrable pulmonary pathologic process at the present time was found in 10 children.

There were no positive findings in the sputum, gastric contents and feces of all these children.

TREATMENT

The treatment of tuberculous laryngitis in children consists chiefly of vocal rest. We also use instillations of halibut liver oil or cod liver oil and ultraviolet irradiation (Kromayer lamp) directed into the larynx by means of a special quartz applicator. The galvanocautery is used early in the treatment of patients with nonacute superficial and deep ulcerations, edema and tuberculomas. Edematous swellings and tuberculomas are treated by puncture, while the ulcerations are superficially seared. For older children we are able to use the cautery by means of indirect laryngoscopic inspection. Laryngeal pain is controlled by injection into the superior laryngeal nerve or by the use of a spray containing 1 per cent solution of cocaine hydrochloride.

Many chemical applications and special therapeutic measures have been advocated from time to time. The existence of so large a number indicates their lack of real value.

The prognosis is unfavorable when a child has a laryngeal complication with pulmonary tuberculosis. It is not hopeless, however, as was formerly believed. The progress of the laryngeal condition usually keeps pace with that in the chest. Improvement and recovery can and do occur. One of our children has a completely healed larynx, despite the fact that the sputum has remained positive and further surgical treatment of the chest will be necessary. Most of the children with extensive pulmonary lesions, however, succumb before the throat has healed. The employment of collapse therapy has undoubtedly improved the prognosis. Blumenfeld and Goebel [7] have reported a reduction in the mortality from 90 to 50 per cent after the use of collapse procedures.

SUMMARY

Relatively few children are referred by the pediatrician for laryngeal examination because the early local symptoms are mild and are overshadowed by the constitutional signs. Routine examination of the larynx of all children with pulmonary tuberculosis should be done. Such examination would disclose a larger number with laryngeal involvement. The child's larynx is not exposed to as many irritating factors as that of the adult.

Indirect laryngeal examinations were carried out on 100 tuberculous children, and a large number of lesions were found. Hyperemia and infiltration were the most common findings. These were seen most often in the posterior commissure. The greatest number of lesions were found in the group with caseous pneumonic tuberculosis, and the sputum of these children was most often found to be positive. Changes in the larynx were found in 23 of 54 children with tuberculosis whose

sputum, gastric contents and feces were negative. There were 21 normal larynges found among 46 children whose sputum, gastric contents or feces were positive.

Bronchoscopic examination should be performed on tuberculous children who have negative sputums, because a direct smear will often show the presence of tubercle bacilli. It is contraindicated when active laryngeal lesions exist.

The chief therapeutic measures are vocal rest and the application of the galvanocautery electrode. The general and pulmonary condition must also be treated. Collapse therapy has greatly improved the local condition and the general prognosis.

Case Reports

RECOVERY FROM THROMBOSIS OF THE CAVERNOUS SINUS

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The extreme rarity of a recovery from thrombosis of the cavernous sinus, in addition to the administration of an unusually large amount of sulfanilamide seems sufficient reason for this case report.

REPORT OF A CASE

Mrs. S., aged 19, white, had a history of intermittent suppurative otitis media in the left ear which had followed an attack of scarlet fever during early childhood. I was asked to examine her in her home on Dec. 14, 1938. She was complaining of severe pain in and around her left ear and the left side of her head and neck. According to the patient's mother, her present illness had begun about two weeks previously with an attack of influenza and tonsillitis. During the first days she had had a chill and intermittent chilly sensations followed by fever. On examination I found copious discharge of thick yellow pus from the left ear. There was no drooping of the canal wall and no tenderness or edema over the mastoid process. The right ear and mastoid were normal. She also had a bilateral purulent nasal discharge, and both tonsils were enlarged and inflamed. The lymph glands in the region of the angle of the left jaw were enlarged considerably and tender to the touch. The temperature was 100 F. The patient's general appearance was that of a very sick person. A thorough examination in the home being impossible, it was advised that she be taken to the hospital or my office for further examination. I heard nothing more from the family until five days later, when the mother informed me that her daughter's general condition was much worse and that both her eyes were badly swollen. She was then brought to the hospital.

On admission it was found that the patient had a high degree of proptosis of both eyes, accompanied by chemosis of the conjunctivas. The proptosis of the left eye was so marked that the lids could not cover the eye. The swelling at the angle of the left jaw had increased considerably. The patient complained of severe generalized intermittent headache which was most intense over the right frontal region and was worse at night. The temperature was 102.6 F., but there was no repetition of chills or chilly sensations. There was a copious discharge from the left ear but no drooping of the canal wall, pain on pressure or edema over the left mastoid area.

A diagnosis of thrombosis of the cavernous sinus was made; the usual prognosis was anticipated, and no hope for recovery was given to the family. It was surmised that thrombosis of the lateral sinus existed on the left side and had extended to the jugular bulb and vein and also through the petrosal sinuses to the cavernous sinus, which had become involved. Because a diagnosis of thrombosis of the cavernous sinus had been made and the patient's general condition was poor, surgical intervention on the mastoid did not seem to offer any hope and so was not resorted to until later. Hemolytic streptococci were found in a culture of material taken from the ear.

Therapy.—Sulfanilamide, 20 grains (1.29 Gm.) and later 15 grains (0.97 Gm.) was given every four hours. The patient was also given 60 cc. of a polyvalent

antistreptococcus serum during the first three days in the hospital, and in addition blood transfusions of 500 cc. each were given on the third, the sixth, the sixteenth and the forty-fourth day.

Course.—The swelling at the angle of the jaw increased in size rapidly, owing to an enlargement of the cervical glands and also to edema and cellulitis. The left wall of the throat and the tonsil were dislocated to the right until the patient had great difficulty in breathing. On December 22, four days after her admission to the hospital, an incision was made into the edematous peritonsillar area, but no pus was found. After several days the edema of the neck and throat began gradually to subside. The glandular swelling remained until after the operation on the mastoid. The patient's general condition improved remarkably during the first week in the hospital. The proptosis in the left eye and the edema and swelling in the throat improved, and the temperature became less septic. In other words, the entire septic picture showed definite improvement, and consequently the operation on the mastoid was postponed for fear that it might cause another exacerbation of the general septic condition.

Finally, on Jan. 3, 1939, fifteen days after her admission, a radical operation was performed on the left mastoid. The cortex was sclerotic, but considerable destruction of bone and pus was found in the region of the antrum and around the sigmoid sinus. The sinus was opened and found to contain an organized clot, which did not seem to be infected. No attempt was made to remove the clot or to ligate the jugular vein. After the operation the swelling in the neck subsided rather rapidly.

On January 12, nine days after the operation on the mastoid, severe pain developed in the right eye and over the entire right side of the head, with an increase of the proptosis and chemosis of the right eye. A tumefaction gradually developed in the conjunctiva of the lower part of the fornix, pushing the eyeball upward and outward. On January 27, sixteen days after the tumefaction began, it was incised and a large quantity of pus evacuated, with immediate relief. After the evacuation of the orbital infection the patient's general and local condition improved rapidly. She was able to leave the hospital on February 11, having been hospitalized for fifty-five days.

A few days after the patient's return home an excruciating pain in the right eye again developed, with extreme proptosis. At this time a corneal ulcer developed, and for several days panophthalmitis threatened, but after drainage of the orbital infection the entire inflammatory process subsided, and at the time of writing the vision in this eye is only slightly impaired.

The patient's blood picture during her illness was as follows: On admission, the erythrocyte count was 3,700,000, with 73 per cent hemoglobin, and the leukocyte count was 36,000. The highest leukocyte count was 39,000. The lowest blood count recorded was shortly before she left the hospital, i. e., red cells, 2,960,000, with 48 per cent hemoglobin, and white cells 8,300.

The temperature was 102.2 F. on admission. It rose as high as 104 F. After the first week it rose to 101 F. on one occasion only. There was practically no fever after the second week.

Administration of Sulfanilamide.—The patient received sulfanilamide at four hour intervals during thirty-six days of her stay in the hospital. The total amount given during the period was 2,230 grains (144.5 Gm.).

First National Bank Building.

TREATMENT OF MENINGITIS DUE TO PNEUMOCOCCUS TYPE III WITH SULFANILAMIDE; RECOVERY

DANIEL SILVERMAN, M.D., AND MELVIN THORNER, M.D., M.Sc., PHILADELPHIA

Acute meningitis is one of the most dramatic of all the infections of the nervous system in its sudden onset and rapid progress. Except for meningitides due to the meningococcus and a few other agents, the outlook for the preservation of life is usually poor. The prognosis is particularly unfavorable for pneumococcic meningitis, and a fatal termination has almost invariably occurred. In this paper a case of meningitis due to the type III pneumococcus in which recovery, presumably due to sulfanilamide therapy, occurred is reported. The patient remained well four months after recovery and then died of a disease related to hypertension. The experience at the Philadelphia General Hospital with meningitis due to Pneumococcus type III is reviewed, as are certain aspects of the literature.

REPORT OF A CASE

B. M., a 47 year old Negress, was admitted to the Philadelphia General Hospital, service of Dr. J. C. Yaskin, on May 8, 1938. She had been brought by a friend, who had found her in a generalized clonic convulsion, which was followed by wild, purposeless movements. The patient was delirious on admission, did not recognize her friends and apparently could not speak. The history obtained later from her relatives revealed that nine days before admission she had had a "cold," followed by pain in the right ear. A discharge of pus from the right ear had been noticed on May 5. Disturbances of consciousness and convulsions had not appeared until the day of admission.

In 1925 and 1926 she had received a full course of antisyphilitic therapy. Since 1932 she had been admitted to the hospital on three different occasions for diabetic acidosis. There was a history of chronic alcoholism and of intermittent trouble with the ears.

On admission the patient was restless and did not respond effectively to stimuli. She was moderately well nourished, although obviously acutely ill and febrile. She flung her arms and legs about purposelessly. Her blood pressure was 230 systolic and 166 diastolic, and her heart was enlarged to the left. There was a purulent discharge from the right ear. Nuchal rigidity was marked, and the Kernig and Brudzinski signs were present. The tendon reflexes were all active. During the examination right-sided jacksonian convulsions were noted. There was no Babinski sign. A spinal tap done at this time released cloudy fluid, the pressure of which was 10 mm. of mercury.

The spinal fluid on May 8 contained 2,100 cells, of which 95 per cent were polymorphonuclear, and a pure culture of Pneumococcus type III was grown. The Wassermann reaction of the spinal fluid was negative. Examinations of the blood yielded the following data: sugar content, 244 mg. per hundred cubic centimeters; carbon dioxide-combining power, 44 volumes per cent; urea nitrogen

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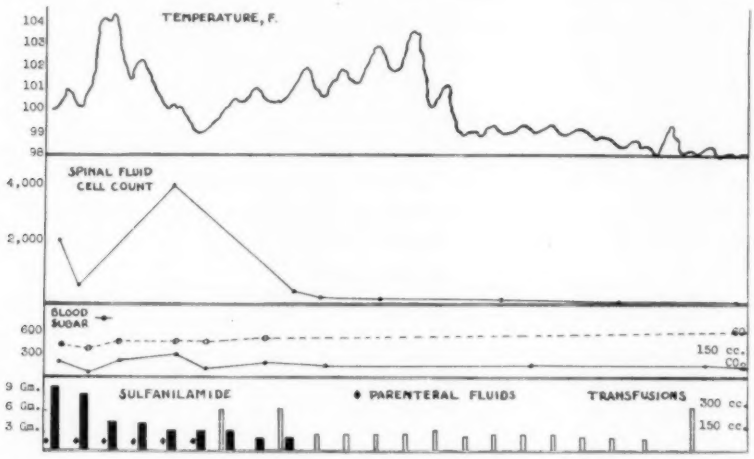
content, 8 mg. per hundred cubic centimeters; culture, sterile. The blood count showed 3,900,000 erythrocytes, with 10 Gm. of hemoglobin and 14,800 leukocytes, of which 97 per cent were polymorphonuclear cells. The urine contained sugar.

The diabetes mellitus was treated by Drs. E. S. Dillon and W. W. Dyer, at first with intravenous administration of dextrose in a saline solution and insulin and later with a diabetic diet given through a nasal tube. No great difficulty was encountered in controlling the diabetes at that time. During the first twenty-four hours the patient was given 9.3 Gm. of sulfanilamide; the next day, 8 Gm.; the third day, 4 Gm.; the fifth, sixth and seventh days, 3 Gm., and on the eighth day, 2 Gm.

The patient was too ill to be moved so that roentgenograms could be made of the region of the mastoid, which was evidently the source of the meningeal infection. The otologist considered her such a poor surgical risk that operative intervention was not justified. On May 12 she appeared somewhat better but had 4,000 cells in her spinal fluid. Clinical improvement continued, and on May 16



Clinical course of patient.

culture of the spinal fluid was negative and the cell count reduced to 390. However, the patient then had right hemiparesis, and a roentgenogram taken at that time showed evidence of right-sided mastoiditis. Since the hemoglobin content had fallen to 9.5 Gm. as a result of the disease and of the sulfanilamide therapy combined, several blood transfusions were given. Clinical improvement from then on was rapid; the patient became cooperative; the temperature returned to normal, and the ear drum healed and resumed a normal color and contour. Repeated cultures of the spinal fluid revealed no organisms, and the cells gradually disappeared. The only sequelae which remained four months after the onset were right monoplegia brachialis and aphasia. The treatment for diabetes was standardized at 30 units of protamine zinc insulin daily with a controlled diet. The patient remained in the neurologic ward as an ambulatory patient.

She continued to be well until the morning of September 20, when she felt ill and stayed in bed. Examination revealed moderate nuchal rigidity and inflammation of the right ear drum. The spinal fluid pressure was normal and the fluid turbid, containing 1,640 cells, of which 67 per cent were polymorphonuclear. The leukocyte count for the blood was 26,000, with 98 per cent polymorphonuclear cells.

The sugar content of the blood was 520 mg. per hundred cubic centimeters and the carbon dioxide–combining power 31 volumes per cent. The patient rapidly became stuporous and was comatose by afternoon, when she had a series of generalized convulsions. She was treated for diabetic acidosis, and the next morning (September 21) the sugar content of the blood was 67 mg. per hundred cubic centimeters and the carbon dioxide–combining power 70 volumes per cent. She was given sulfanilamide, 8 Gm. the first day, 6 Gm. the second and the third day, 3 Gm. daily from the fourth to the eleventh day and 2 Gm. daily for the last two days of her life. For a few days she showed symptomatic improvement. Culture of material removed from the right ear after myringotomy revealed type III pneumococci, and roentgenograms of the region of the mastoid showed evidence of mastoiditis on the right. The cell content of the spinal fluid decreased to 610, then to 83 and on the last day of her life to 70. At no time during this period were organisms found in the spinal fluid. The patient became moribund suddenly on September 30. The sugar content of the blood, which had steadily been climbing, was 520 mg. per hundred cubic centimeters, and the carbon dioxide–combining power was 37 volumes per cent. Diabetic acidosis and coma progressed until death, despite massive doses of insulin.

Postmortem examination (Drs. K. M. Corrin and H. E. Riggs) revealed arteriosclerotic cardiovascular disease with some passive congestion. The brain showed marked fibrosis of the arachnoid throughout, a fairly large area of softening in the left temporal lobe and many smaller areas of softening in the hemispheres and brain stem. Acute inflammatory reaction of the meninges was not observed on gross or microscopic examination. The right mastoid cells were necrotic. The pancreas showed severe atrophy and fibrosis, with dilatation of the ducts. Some pancreatic calculi also were present. Nephrosclerotic disease was moderate to marked.

This case is of interest from several points of view. With a background of diabetes mellitus, hypertensive disease and alcoholism, the patient's chances for recovery from pneumococcic meningitis seemed extremely poor. She was desperately ill on admission, and in the face of this situation the treatment consisted solely of administration of sulfanilamide and control of the diabetes. We feel that recovery would not have occurred but for this therapy. The residuum of aphasia and hemiparesis was evidently due to the area of softening in the left hemisphere.

The acute clinical meningeal reaction which preceded death (from diabetic acidosis) might have been occasioned by the leakage of necrotic material from the area of softening into the subarachnoid space. The absence of any organism in the spinal fluid during this terminal episode and the lack of postmortem evidence of acute inflammatory meningitis make reinfection as a cause of the terminal episode unlikely.

GENERAL COMMENT

In the wards of the Philadelphia General Hospital from Jan. 1, 1936, to Aug. 1, 1938, 130 cases of acute meningitis were observed. In 40 of these, or 30.8 per cent, the cause was the pneumococcus, and in 12 of these cases the organism was of type III. In 10 of the 12 cases the origin was otitic, and in all except that here reported acute meningitis caused death. In 4 cases other than that here reported treatment was with sulfanilamide. In 1 the dose was inadequate—3 Gm. in twenty-

four hours. In the second intensive treatment with sulfanilamide, prontosil [1] and drainage of spinal fluid was instituted. The patient lived eight days and died with the spinal fluid too thick to drain. In the third meningitis developed one month after mastoidectomy, and the patient died after a week of therapy with sulfanilamide. In the fourth the patient received sulfanilamide, improved and was submitted to mastoidectomy and craniotomy, at which an extradural abscess was found. Administration of sulfanilamide was continued, and the cell count of the spinal fluid was reduced, but death occurred from cerebral edema. Each of the last 3 patients lived longer than those not treated with sulfanilamide.

Data on Cases of Meningitis Due to the Type III Pneumococcus in the Philadelphia General Hospital from Jan. 1, 1936, to Aug. 1, 1938

Race	Sex	Age	Source	Complications	Blood Culture	Cell Count or Condition of Spinal Fluid	Days in Hospital	Treatment
W	M	56	Otitis	.....	.....	Purulent	1	None
W	F	60	Otitis	.....	Positive	2,760	1	None
N	M	37	Otitis	.....	.....	Purulent	3	None
N	F	50	Otitis	Diabetes	Positive	15,500	2	None
N	M	52	Pneumonia	.....	.....	700	2	None
W	F	28	Otitis	.....	.....	2,500	1	None
W	M	55	Endocarditis	Alcoholism	.....	2,500	1	None
W	M	20	Otitis	.....	Positive	18,000	8	Administration of sulfanilamide and prontosil[1]
W	M	56	Otitis	Echinococcic cyst of liver	.....	6,400	2	Administration of sulfanilamide
N	F	49	Otitis	.....	Positive	500	92	Mastoidectomy, administration of sulfanilamide
W	F	33	Otitis	.....	Negative	4,240	13	Mastoidectomy, administration of sulfanilamide
N	F	47	Otitis	Diabetes; hypertension; alcoholism	Negative	4,000	147	Administration of sulfanilamide

We have found reported in the literature only 8 recoveries from meningitis proved to be due to the type III pneumococcus. In the first case [2] the patient received successively antimeningococcic serum, antipneumococcic serum and ethylhydrocupreine hydrochloride administered intrathecally and daily drainage of spinal fluid. The authors expressed the belief that the ethylhydrocupreine hydrochloride had specific therapeutic value. In the case reported by Weinberg [3] recovery followed

1. The disodium salt of 4-sulfamidophenyl-2′-azo-7′-acetylamino-1′-hydroxynaphthalene-3′, 6′-disulfonic acid. This is the substance previously known as prontosil soluble and now to be called neoprontosil.

2. Ratnoff, H. L., and Litvak, A. M.: Pneumococcus Meningitis Treated with Morgenroth's Optochin Hydrochloride, Arch. Pediat. **43**:466, 1926.

3. Weinberg, M. H.: Case of Pneumococcus (Type III) Meningitis Treated with Potassium Permanganate; Recovery, J. Nerv. & Ment. Dis. **74**:38, 1931.

enemas of potassium permanganate. In Cavenagh's case [4] recovery occurred without any specific therapy. In the case reported by Steinholz and Gleich [5] treatment was with nonspecific serum administered intrathecally; in this case the organism was shown experimentally to have been attenuated. The case reported by Tripoli [6] was one of primary meningitis occurring six days after spinal puncture for anesthesia; treatment was with nonspecific serum administered intrathecally and drainage of lumbar and cisternal spaces. Allman [7] reported the case of a 15 year old girl who recovered after mastoidectomy. Two cases of meningitis due to the type III pneumococcus in which recovery occurred after the use of sulfanilamide have been reported. In Gubner's case [8] a 5½ year old boy in whom meningitis followed mastoidectomy was treated by sulfanilamide, transfusions and reopening of the mastoid wound. In the case of Finland, Brown and Rauh [9] a 10 year old boy recovered after treatment with sulfanilamide, mastoidectomy and autoserum administered intrathecally.

The action of sulfanilamide against the type III pneumococcus has been demonstrated experimentally and clinically. Rosenthal showed its effectiveness in high dilutions in vitro [10] and in protecting mice [11] and rabbits [12] from lethal intraperitoneal inoculations. Cooper and his associates have also shown that sulfanilamide administered orally is curative against infections with the type III pneumococcus in mice [13] and against experimental pneumonia in rats.[14] Clinically, excellent results against pneumonia due to the type III pneumococcus have been reported by

4. Cavenagh, J. B.: Recovery from Pneumococcal Meningitis, J. Laryng. & Otol. **48**:337, 1933.

5. Steinholz, R., and Gleich, M.: Pneumococcus (Type III) Meningitis; Recovery, J. A. M. A. **105**:795 (Sept. 7) 1935.

6. Tripoli, C. J.: Bacterial Meningitis Comparative Study of Various Therapeutic Measures, J. A. M. A. **106**:171 (Jan. 18) 1936.

7. Allman, C. M.: Meningitis Due to the Type III Pneumococcus: Review of the Literature and Report of a Case of Otitic Origin with Recovery Following Radical Mastoidectomy and Labyrinthectomy, Arch. Otolaryng. **25**:653 (June) 1937.

8. Gubner, J.: Recovery of a Patient with Type III Pneumococcus Meningitis of Otitic Origin, Arch. Otolaryng. **28**:241 (Aug.) 1938.

9. Finland, M.; Brown, J., and Rauh, A.: Treatment of Pneumococcic Meningitis, New England J. Med. **218**:1033, 1938.

10. Rosenthal, S. M.: The Effect of *p*-Aminobenzene Sulphonamide on Pneumococci in Vitro, Pub. Health Rep. **52**:192, 1937.

11. Rosenthal, S. M.: Chemotherapy of Experimental Pneumococcus Infections, Pub. Health Rep. **52**:48, 1937.

12. Rosenthal, S. M.; Bauer, H., and Branham, S. E.: Comparative Studies of Sulphonamide Compounds in Experimental Pneumococcus, Streptococcus and Meningococcus Infections, Pub. Health Rep. **52**:662, 1937.

13. Cooper, F. B.; Gross, P., and Mellon, R. R.: Action of *p*-Aminobenzenesulfonamide on Type III Pneumococcus Infections in Mice, Proc. Soc. Exper. Biol. & Med. **36**:148, 1937.

14. Gross, P., and Cooper, F. B.: Efficacy of *p*-Aminobenzenesulfonamide in Experimental Type III Pneumococcus Pneumonia of Rats, Proc. Soc. Exper. Biol. & Med. **36**:225, 1937.

Louis,[15] Millet[16] and Heintzelman, Hadley and Mellon.[17] Since the drug is easily absorbed from the gastrointestinal tract and appears in a comparatively short time in the spinal fluid in but slightly less concentration than in the blood,[18] it seems that the oral route of administration of sulfanilamide is adequate for the treatment of meningitis. From our limited experience in the cases here reviewed, sulfanilamide appears effective against some meningeal infections due to the type III pneumococcus, as it is against infections with this organism elsewhere.

SUMMARY AND CONCLUSIONS

Meningitis due to the type III pneumococcus is extraordinarily lethal. The recoveries we have found reported in the literature total 8, of which the latest 2 followed treatment with sulfanilamide and operative procedures directed against the primary focus of infection. In the case reported here the patient's desperate condition prevented the otologist from performing mastoidectomy, so that her recovery from the acute meningitis, we feel, was due solely to the action of sulfanilamide. The fact that the prognosis was made so unfavorable by the complicating systemic conditions, marked hypertension and diabetes and chronic alcoholism, makes a more than ordinarily strong argument in favor of hope from the use of sulfanilamide against meningitis due to the type III pneumococcus.

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15. Louis, D. J.: Treatment of Pneumonias with Sulphanilamide, Illinois M. J. **73**:422, 1938.

16. Millet, J.: The Action of Sulfanilamide in a Case of Type III Pneumococcus Pneumonia, New York State J. Med. **37**:1743, 1937.

17. Heintzelman, J. A. L.; Hadley, P. B., and Mellon, R. R.: Use of *p*-Aminobenzenesulfonamide in Type III Pneumococcus Pneumonia, Am. J. M. Sc. **193**:759, 1937.

18. Marshall, E. K.; Emerson, K., Jr., and Cutting, W. C.: Para-Aminobenzenesulfonamide—Absorption and Excretion: Method of Determination in Urine and Blood, J. A. M. A. **108**:951 (March 20) 1937.

New Instruments

SIMPLIFIED APPARATUS FOR LARYNGEAL CINEMATOGRAPHY

ADRIAN SOLO, M.D., SOMERVILLE, MASS., AND NATHAN L. FINEBERG, M.D., AND GEORGE LEVENE, M.D., BOSTON

The apparatus herein described embodies two unique features: (1) simplicity and (2) construction from standard equipment.

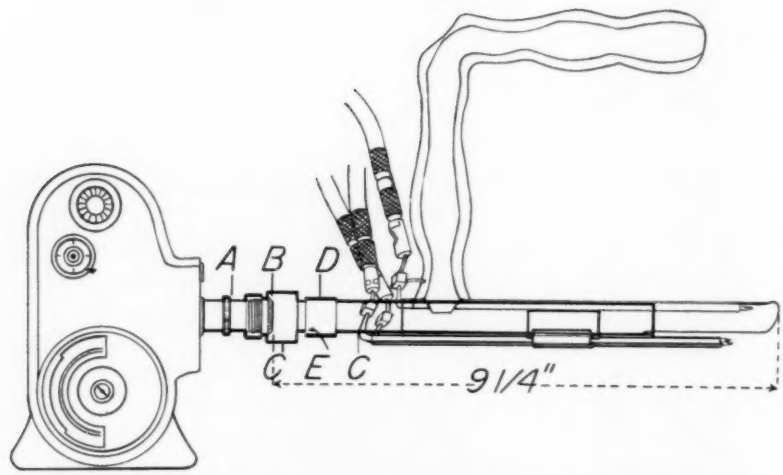
The camera is a "filmo 8," using 8 mm. film. It is equipped with a Taylor-Hobson F. 2.5 universal focus lens opened to its widest aperture. The focal image obtained at a short working distance, which in our case is 10¼ inches (26 cm.), is sharpened by the addition of a front lens. The source of light consists of three 4 watt bronchoscopic bulbs, of which one is carried in its usual channel and the other two are carried in a holder which clips onto the laryngoscope.

A connecting brass tube is made to fit snugly onto the sleeve of the camera lens (*A*) by a tight sliding joint (fig. 1). The other end of this tube is threaded to receive a no. 3 Leica (F. 3.5) front lens (*B*). Attached to the collar of the front lens by a tight, sliding fit is a brass tube (*C*) 5½ inches (14 cm.) long, the caliber of which permits it to slide into the lumen of the 16 mm. Pilling laryngoscope. The tube is inserted to a marked point so that the front of the lens (*B*) is 9¼ inches (23.5 cm.) from the tip of the laryngoscope. This affords a depth of focus of 1 to 1½ inches (2.5 to 3.8 cm.) ahead of the laryngoscope. The extension tube (*C*) has a light-tight collar (*D*) covering a series of breathing holes (*E*), which assist breathing and reduce condensation of moisture on the front lens.

The apparatus is used as follows: The camera is loaded with Eastman panchromatic film and set to run at 10 frames a second. Tube *C* is inserted into the laryngoscope to its proper distance. The clip carrying the two extra bulbs is snapped into position and the laryngoscope introduced. The front lens adapter and front lens (as a single unit) are wrapped in a hot-water bottle to bring the lens to body temperature. The adapter, being turned out of solid brass, will hold heat sufficiently long to permit exposure of 8 to 10 feet (2.4 to 3.3 meters) of 8 mm. film. The adapter and lens are slipped over the lens of the camera and the whole assembly connected to the extension tube (which is already in position in the laryngoscope) by a tight sliding joint. By careful machining the parts are made to fit snugly, so that the entire assembly is rigid as a single unit and automatically alined. Good pictures may be obtained unless the patient moves considerably.

The pictures in figure 2 were obtained with the apparatus described, using Eastman panchromatic film, which has a Mazda Weston rating of 6. Better results have since been obtained by using "Kodachrome A," which has a Mazda Weston rating of 12.

From the Departments of Otolaryngology and Radiology, Massachusetts Memorial Hospitals.



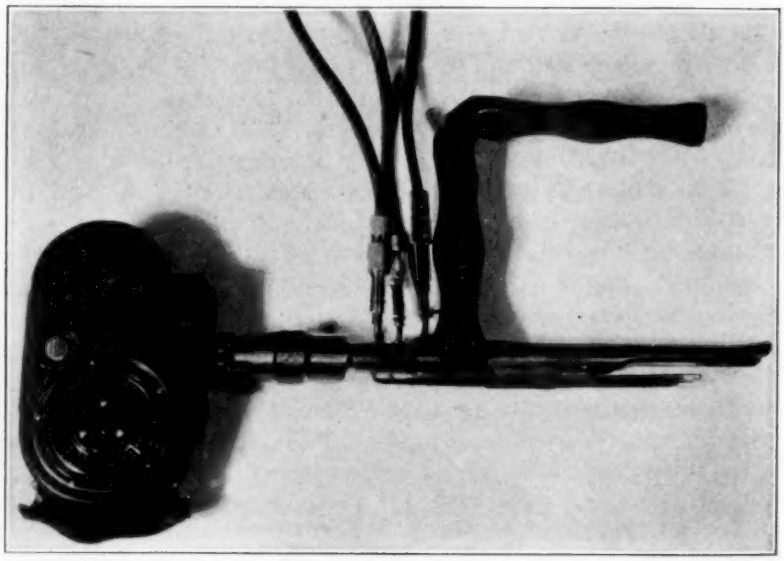


Fig. 1.—Above, schematic drawing of the apparatus for laryngeal cinematography. Below, photograph of the complete assembly ready for use.

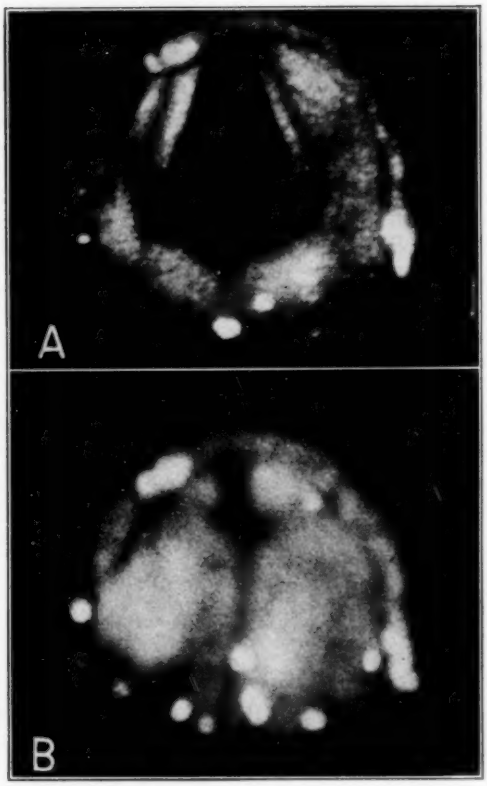


Fig. 2.—Enlarged photographs of the larynx (unretouched) obtained with the apparatus shown in figure 1. *A*, normal larynx; *B*, postdiphtheritic atrophy of the vocal cords.

A MICROAPPLICATOR FOR USE IN OTOLOGIC WORK

G. R. Lacy, M.D., and F. A. Lanson, M.D., Pittsburgh

Bacteriologic examination of material from the middle ears following paracentesis of the ear drum has always been more or less unsatisfactory. The difficulty has been due to contaminations encountered along the wall of the external auditory canal. This has been particularly true in dealing with infants and small children, in whom the canal is small. The ordinary wooden applicator tipped with a piece of cotton is so large that it is practically impossible to pass it through the canal without contaminating it with organisms which have nothing to do with the pathologic condition within the middle ear. These organisms are usually in considerable numbers and grow so freely on culture mediums that they have a tendency to overgrow or to inhibit entirely the growth of the pathogenic organisms in the exudate from the middle ear. Not infrequently the otologist is convinced that he is dealing with an infection due to a streptococcus, a pneumococcus or Haemophilus influenzae, and the bacteriologist can find only a diphtheroid bacillus, a staphylococcus or some other relatively nonpathogenic organism.

In order to overcome this difficulty, we have devised a microapplicator for collecting the exudate from the middle ear. This instrument can be passed through the smallest ear speculum for infants. Prior to myringotomy, it has been our practice to remove the ear wax, desquamated epithelium and other contaminating material. After the removal of this material, the external auditory meatus is filled with 70 per cent alcohol, which is allowed to remain for two minutes. The head is then turned so that the alcohol escapes by gravity. Two or three minutes is allowed for the alcohol to evaporate from the skin. A small sterile ear speculum is then introduced as far as possible into the auditory canal; the myringotomy is performed, and the exudate is collected on the sterile microapplicator, which is passed through the speculum in situ. By following this procedure, we have been able to isolate pneumococci, streptococci and Haemophilus influenzae from exudates of the middle ear without difficulty and with surprising regularity. The results of our cultures are reported elsewhere.

The instrument is made of a small piece of cotton attached to a 22 gage chromel-A[1] wire about 7 to 8 inches (18 to 20 cm.) long. The cotton must be wound securely about one end of the wire so that it will not be lost in the process of

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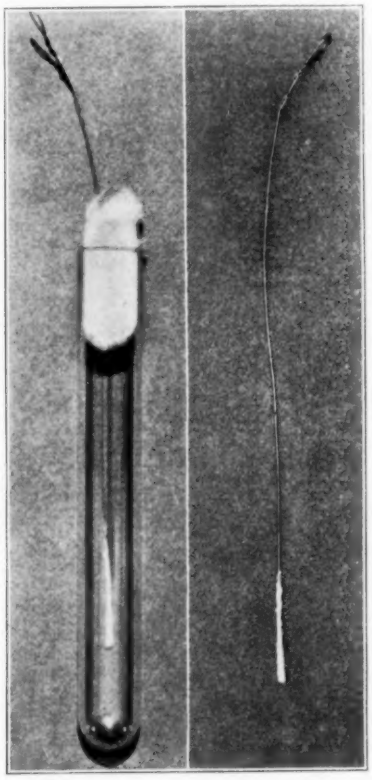
From the Children's Hospital and the Department of Pathology, University of Pittsburgh.

1. The chromel-A wire which we used was made by Hoskins Manufacturing Company, of Detroit, and purchased from the Fisher Scientific Company, of Pittsburgh. It has been used by us as a substitute for platinum wire in bacteriologic work.

collecting the material for culture. It can be attached to the wire either by slightly dampening it and winding it tightly about the wire or by making small barbs on the wire near the end with a knife and winding it about the wire at this point. The opposite end of the wire should be turned back to form a loop, which acts as a handle. The accompanying photograph illustrates this. The applicator thus prepared can be placed in a clean test tube 6 inches (15 cm.) long and sterilized in the usual manner. The wire is rust proof and can be used almost indefinitely. In case of necessity, the wire can be sterilized in flame, a piece of sterile cotton then wound about it with sterile-gloved fingers and



Photographs of the microapplicator.

the swab used without further delay. When the material has been collected on the swab, the latter should be placed in the culture medium and permitted to remain there during the incubation. The fluid medium can then be plated as the occasion demands.

The recent success in chemotherapy of streptococcic and pneumococcic infections emphasizes the importance of accurate bacteriologic examinations of exudates from the middle ear. The use of this microapplicator has been of inestimable value to us in securing satisfactory material for these examinations. There is probably a use for this instrument in any type of surgical procedure in which a small applicator is needed.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

THE PARANASAL SINUSES

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The literature for 1938 has been unusually voluminous and to a large degree repetitious. Yet, even though the nuggets of genuine brilliance are few and far between, it is worth while noting how trends in diagnosis and treatment develop on the basis of the discoveries and writings of a few recognized leaders and soon become the accepted pattern. The more widespread the discussion of problems concerning the sinuses, the more hope for their early solution. While uniformity is more or less a utopian ideal, the nearer it is approached the better for both physician and patient.

ANATOMY AND EMBRYOLOGY

On the basis of studies made on the heads of 25 cadavers by filling the sinuses with Wood's metal, Mikhaloyts [1] made a number of measurements, both linear and of capacity, drawing certain conclusions as to the correlation of the various sinuses with each other, and the correlation of sinal and facial measurements. The chief emphasis is laid on the absence of relation between the shape of the face and the capacity of the sinuses, as well as between the capacity of the maxillary sinuses and the linear dimensions (breadth and height) of the facial skeleton. The sum total of capacities of the left sinuses is greater than that of the right, and the average size of the individual sinuses is greater. The only exception seems to be the right frontal sinus, which is larger on the average than the left.

A similar study by Mündnich,[2] based on 100 macerated skulls, discloses several factors not entirely in agreement with those brought out in the preceding investigation. The author found that antrums are larger in brachycephalic heads than in dolichocephalic and that other

1. Mikhaloyts, N. I.: Correlative Variability of Volumes of Paranasal Sinuses, Zhur. ush., nos. i gorl. bolez. **15**:45, 1938.

2. Mündnich, K.: Zum Pneumatisationsproblem der Nasennebenhöhlen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **43**:5, 1937.

factors influencing the size of these cavities are (*a*) prominence of the zygoma, (*b*) position of the lateral boundaries of the alveolar process and (*c*) width of the nasal cavity proper. Excessive size of the antrum takes place in the vertical and sagittal planes mainly. The alveolar process is pneumatized in 40 per cent of the normal specimens but in only 25 per cent of those with a deep canine fossa. In the latter type the floor of the sinus may be higher than the nasal floor, which will make puncture difficult because of the thickness of the bone. The author found parallel development of the antrums and mastoids, confirming Schwartz's theory regarding constitutional factors inherent in the mucosa.

Jones [3] studied the skull of a young gorilla in which the bony sutures were still visible and found that there was no true maxillary sinus. Two cavities were present in the superior maxilla; one of these, which has been called the "bulla ossea nasolacrimalis," opens into the inferior meatus and is an expansion of the lower end of the lacrimal duct. This bulla bulges backward into a larger cavity, which partially surrounds it and which opens into the middle meatus but which is shown to originate far back in the ethmoid region. This cavity is called an ethmoidal "antrum." The author cites several investigators corroborating his findings.

Abbate [4] reports an anomaly of the maxillary sinus in a boy of 17, in whom operation revealed a sagittal partition of bone about 2 mm. in thickness placed diagonally so that the antrum was divided into two cavities: a larger superolateral and a smaller inferomedial. The large portion extended into the zygomatic recess and contained quantities of granulations and pus. A narrow opening in the party wall afforded inadequate communication between the two spaces.

Rosenberger [5] examined 134 adult skulls, using only the right half on account of retaining the septum so as not to prejudice or facilitate passage of a cannula. He found it possible to catheterize 46 per cent of the skulls of white persons and 48 per cent of those of Negroes. This is a lower percentage than reported by Van Alyea. Seventy per cent of the ostiums were located in the lower third of the hiatus. Among 70 of his private patients Rosenberger was able to catheterize 68 per cent successfully. He favors the Turnbull catheter, because the tip is more flexible.

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3. Jones, F. W.: The So-Called Maxillary Antrum of the Gorilla, J. Anat. **73**:116 (Oct.) 1938.

4. Abbate, L.: Considerazioni su di un'anomalia del seno mascellare, Arch. ital. di otol. **49**:431 (Sept.) 1937.

5. Rosenberger, H. C.: The Clinical Availability of the Ostium Maxillare: A Clinical and Cadaver Study, Ann. Otol., Rhin. & Laryng. **47**:176 (March) 1938.

Barth [6] refers to a statement frequently encountered in the literature, that atrophic rhinitis is associated with arrested development of the sinuses. He attempts to refute this assertion by roentgen study of 82 patients having genuine atrophic rhinitis. These studies when compared with those of a control group of 300 normal persons revealed that the percentage of poorly pneumatized frontal bones was no greater in the former than in the latter. He calls attention to the fact that 17 of his patients were known to have had the disease early in life and yet their frontal sinuses were not affected. In 8 other patients the frontal sinuses were well developed, whereas the other sinuses were not. Roentgen studies in families in which atrophic rhinitis was common did not show a connection between the development of the frontal sinuses and the incidence of atrophic rhinitis. In a previous article by the same author [7] an attempt is made to discover whether sinal infection in childhood has any influence on the subsequent development of the frontal sinuses. In general, the author reports, the sinuses developed despite the infection. In one group in which the frontal sinuses failed to develop, a study of the family tree proved that certain hereditary factors were the true cause and that the infection had nothing to do with the retarded pneumatization.

On the basis of roentgen studies of 370 heads, Guidotti [8] establishes the principal variants of the fissura orbitalis superior and divides them into certain characteristic types, namely: (1) triangular, (2) Phrygian cap shaped, (3) clove shaped, (4) clove shaped with spiny processes, (5) oval and (6) rectangular or quadrilateral. Orientation of the fissure with the cranial bones is bound up morphologically with characteristics of the skull. The polymorphism of the fissure needs much study in order to interpret roentgenograms adequately and distinguish abnormal from normal.

Sato [9] made a number of macroscopic and microscopic studies of sinuses in dogs, cats, birds and amphibians. The detailed findings in each group are too numerous for abstracting. It is interesting to note that he found that the lining membrane of the sinuses in all the animals was stratified epithelium covered with ciliated epithelium, except in the

6. Barth, H.: Die Pneumatisation der Stirnhöhlen bei der Rhinitis atrophicans simplex bzw. Ozaena, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:135, 1938.

7. Barth, H.: Ueber den Einfluss der Nebenhöhlenentzündungen im Kindesalter auf die Pneumatisation der Stirnhöhlen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **43**:149, 1937.

8. Guidotti, C.: L'aspetto radiografico della "fissura orbitalis superior," Radiol. med. **24**:1074 (Dec.) 1937.

9. Sato, J.: Vergleichende Studien über die Morphologie und den Bau der Schleimhaut der Nasennebenhöhlen bei verschiedenen Tieren (Säugetieren, Vögeln und Amphibien), Mitt. a. d. med. Akad. zu Kioto **22**:277, 1938.

dove, in which the membrane consists of a single layer of cuboidal epithelium covered with a ciliated layer. Goblet cells were found in all the animals except birds. In the tunica propria of the maxillary sinus of all mammals were many glands, while in the mucosa of the other sinuses no glands were found. The author discusses theories of function and concludes that the sinuses serve to furnish heat and moisture to the inspired air, especially in deep breathing, and he believes that his studies support this theory, which was originally proposed by Eckert-Mobius.

In a rather lengthy article, accompanied by some interesting roentgenograms, Porta [10] presents the result of his studies of the venous channels of the cranial diploe. Much of the work was based on an examination of the collection at the Anatomic Institute of Siena (Professor Lambertini). Numerous variations in the distribution and anastamoses between the three principle diploetic venous systems, frontal, parietal and occipital, are discussed. The size and distribution of the veins bears no relation to the degree of pneumatization of the sinuses. Variability is individual, the entire system being much more extensive in some than in others. The author believes that careful analysis of roentgenograms in cases of acute and of chronic sinusitis may enable one to locate the prominent diploetic veins draining the affected area.

PHYSIOLOGY

Larroude [11] found two zones of ciliary activity in the nose, one comprising the anterior third of the lateral nasal wall, which he calls the zone of slow expulsion, the cilia sweeping forward toward the nares and requiring twenty minutes for complete expulsion of material, and the other a zone of rapid expulsion, where the cilia sweep backward, foreign particles being moved at the rate of 5 mm. per second. Two cases of total laryngectomy were studied to determine the effects of suspended nasal breathing on ciliary activity. He found that the slow zone was not materially affected but that in the rapid zone the rate of expulsion began to slow up after six months, so that at the end of a year it required twenty minutes for foreign particles to be expelled and at the end of two years the time required was an hour or more. The author expects to make a further report on the ciliary activity of the maxillary sinus in these patients, since he believes that the normal changes in pressure within the sinus during respiration must have some influence on the rapidity of ciliary movements.

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10. Porta, C. F.: Considerazioni sul comportamento del circolo venoso diploico, nelle affezioni inflammatorie della base cranica, Arch. ital. di otol. **50**:57 (Feb.) 1938.

11. Larroude, C.: A mucosa das fossas nasais e dos seios peri-nasais (nova prévia), Lisboa méd. **15**:151 (March) 1938.

Following their earlier study on the lymphatic pathways from the nasal mucosa to the lungs, Larsell, Veazie and Fenton [12] undertook a new series of experiments, which tend to support their previous conclusions. Cultures of streptococci were inoculated into the frontal sinuses of cats and rabbits. (In some animals the material was injected directly into the paralaryngeal lymph nodes.) The animals were killed after from one to one hundred and four hours, and the nodes, the lungs and parts of the liver and spleen were removed under aseptic conditions for bacteriologic study. The tracheobronchial route of entry could not be entirely eliminated, as in their experiments with trypan blue, because "the insertion of a tracheal cannula to eliminate material from the upper part of the respiratory region in itself favors bacterial contamination." Aspiration, however, was guarded against by traumatic occlusion of the ostium of the sinus and by the proper posture of the head during the experiment. The bacteria were recovered in largest numbers from the paralaryngeal lymph nodes. They were found also in the liver and the spleen. The conclusions are that the bacteria are carried via these nodes into the lymphatic vessels draining into the great veins, thence to the right side of the heart and then to the pulmonary capillary bed, from which point they may reach the pulmonary tissues or be carried by the blood stream to other parts of the body. "Most of the organisms that pass through the lungs are apparently filtered out of the blood stream by the spleen and by the Kupffer cells of the liver."

Scheideler [13] made a series of experiments to determine the normal air currents within the nasal cavities. These tests were along the lines of those reported some time age by Proetz. A model four times normal size, with a transparent septum, was employed, and cigaret smoke aspirated by a pump at the choana was photographed as it eddied through the nasal meati. The accompanying illustrations are interesting. The importance of the middle turbinate in dividing and directing the stream of air is well brought out in the experiment in which this structure is removed. Removal of the inferior turbinate leads to even greater stagnation, so that it is easy to understand why patients with atrophic rhinitis often complain of inadequate nasal breathing despite their wide open meati.

Müller [14] devised a method of measuring the variations in air pressure within the antrum in relation to pressure in the nasal cavity and

12. Larsell, O.; Veazie, L., and Fenton, R. A.: Streptococcic Infection of the Lungs from the Paranasal Sinuses: Experimental Study, Arch. Otolaryng. **27**:143 (Feb.) 1938.

13. Scheideler, J.: Die Luftströmungen in der menschlichen Nase bei Atmung, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:228, 1938.

14. Müller, E.: Physiologisches zur Frage der Druckschwankungen in den Nebenhöhlen, Arch. f. Ohrenh-, Nasen- u. Kehlkopfh. **144**:100, 1937.

to the respiratory cycle. A Lichtwitz needle introduced into the antrum was connected with a water manometer. The vestibule of the nose was corked with a large rubber tube connected with a volume-velocity indicator. The respiratory cycle was measured by a pneumographic girdle hooked to a Marey capsule. The three curves were plotted simultaneously by the direct optical method with an electrically driven photokymograph. By this method changes in air pressure could be analyzed during every phase of the respiratory cycle. Many data were recorded, on the basis of which the author concludes that the expulsion of secretions from the middle meatus is largely dependent on the temper and degree of the varying pressures. This applied to the antrum as well, since he found that the pressure within this cavity is influenced by the air pressure and eddies in the middle meatus, as well as by the individual anatomic configuration.

Sangiovanni's [15] experiments merely confirm Proetz's findings on ciliary activity within the antrum. The progress of expulsion of instilled iodized poppyseed oil is recorded by frequent roentgenograms, which show the direction of the fluid at the various stages. The author finds the normal emptying time the same as previously reported by others.

In an attempt to explain reflex phenomena such as Sluder's syndrome, Larsell, Barnes and Fenton [16] studied the effects of sectioning the maxillary nerve, the sympathetic trunk and the spinal cord at various levels in experimental animals, making observations on the rabbit's ear, which is transparent enough for the vessels to be seen under a strong light. They showed that the vasomotor response was abolished only by sectioning the cord at the sixth segment or by section of the cervical sympathetic trunk between the middle and inferior cervical ganglions. They believe that the reflex is established by afferent fibers (from the nose) of the seventh nerve to the solitary nucleus where synaptic connections are made in the reticulospinal tract. Impulses along this tract are passed to the sympathetic vasoconstrictors by way of the preganglionic fibers from the lower cervical and the upper thoracic part of the spinal cord.

Pero,[17] after discussing current ideas as to the mechanism of the production of referred cutaneous and musculocutaneous pains, considers more in detail the occipitonuchal pain found in meningeal infections, endocranial tumors and inflammations of the paranasal sinuses. He

15. Sangiovanni, V.: Sulla eliminazione dei liquidi di contrasto dalle cavità paranasali, Arch. ital. di otol. **50**:485 (Sept.) 1938.

16. Larsell, O.; Barnes, J. F., and Fenton, R. A.: Relation of Irritation in the Region of the Paranasal Sinuses to Certain Vasomotor Changes: Experimental Study, Arch. Otolaryng. **27**:266 (March) 1938.

17. Pero, C.: Interpretazione patogenetica del dolore occipito-nucale e della rigidità nucale in alcune affezioni meningo-encefaliche e sinusali, Riv. di pat. nerv. **52**:100 (July-Aug.) 1938.

considers occipitonuchal pain as a sensitive repercussion, or a referred pain, i. e., a *reflesso viscero-sensitivo* in the sense described by MacKenzie.[18] This was corroborated by Lugaro[19] in connection with referred pain from diseases of the celomatic viscera. Nuchal rigidity is an expression of a visceromotor tonic reflex. It is a phenomenon of liberation through suppression of the normal voluntary control which striated muscle exercises on the tonic reflexes of the neck.

Alger[20] derides the theories of Strickland, Kistner and Shea regarding the function of the sinuses and advances his own, to the effect that the sinuses were constructed to serve as reservoirs for nasal secretions which would otherwise flow both forward and backward carrying the risk of asphyxia or aspiration pneumonia, particularly during sleep! He accounts for large amounts of mucus expelled in the morning on the basis of the sinuses emptying themselves when the nose is blown. No scientific data are furnished to support these theories.

PATHOLOGY AND BACTERIOLOGY

Semenov[21] presents an excellent study of the surgical pathology of sinusitis, based on more than a thousand sections examined over a ten year period. He shows that thickening of the mucosa in excess of 2 mm. was associated with deep-seated degenerative changes in 50 per cent of the cases. Purulent sinusitis was found in 72 per cent of the series and nonpurulent hyperplastic polypoid or cystic changes in 28 per cent. It is interesting to note that manifest allergy was found in only 17 per cent, whereas equivocal allergy was noted in 35 per cent. Mixed infection occurred in 80 per cent of the cases; the streptococcus predominated, being found in 94.5 per cent, while staphylococci occurred in 70 per cent. As to postoperative repair following removal of antral mucosa, the author still believes that the newly constructed membrane is a poor substitute for the normal lining but is nevertheless infinitely better than a diseased membrane.

Glatt[22] comes to the same conclusion after examining specimens taken from the newly formed antral mucosa after radical operation at intervals of five weeks to eighteen months. He found that the cavity is

18. MacKenzie, J.: Some Points Bearing on the Association of Sensory Disorders and Visceral Disease, Brain **16**:321, 1893.

19. Lugaro, E.: Fisiopatologia del dolore, Riv. di pat. nerv. **36**:105 (July-Aug.) 1930.

20. Alger, L. J.: A New Theory of Physiology of the Sinuses, Journal-Lancet **58**:511 (Dec.) 1938.

21. Semenov, H.: The Surgical Pathology of Nasal Sinusitis, J. A. M. A. **111**:2189 (Dec. 10) 1938.

22. Glatt, M. A.: Postoperative Repair of the Paranasal Sinuses: Experimental Studies and Their Practical Application, Arch. Otolaryng. **27**:323 (March) 1938.

not always lined with normal stratified columnar ciliated mucosa, there being areas which are merely thin smooth tissue covered with cuboidal epithelium. Remnants of mucosa left in the hope that they will act as islands for regeneration frequently degenerate into scar tissue or become cystic.

MacMahon's [23] recent investigations were for the purpose of ascertaining whether or not sulfanilamide was deposited in the tissues of the noses and sinuses of rabbits in sufficiently large amounts theoretically to affect a streptococcic infection and of studying its effect on some tissues in which infection was not present and on some in which infection had been induced by the instillation of a virulent culture of the hemolytic streptococcus into the paranasal sinuses. The drug was given by mouth to two groups of animals, one apparently normal and the other with artificially infected sinuses. Sulfanilamide was recovered in goodly amounts from the sinuses of both control and infected animals. Since the reaction was not cytologic, the author assumes that the beneficial action of the drug "must be the result of its influence on the organism itself or on its toxins in permitting more active phagocytosis by the . . . leukocytes and monocytes." He states further, "Sulfanilamide should be as effective in the treatment of streptococcic sinusitis as in the treatment of streptococcic infection elsewhere in the body."

Greifenstein [24] disputes the theory that caseous sinusitis is the result of solidification of secretions following occlusion of the ostium. He believes that the accumulation of foul cheesy masses of epithelial debris, pale leukocytes and fat is due to a special local irritation causing an unusual leukocytic infiltration of the subepithelial tissues, which means an abscessed mucosa; this causes irregular fungoid projections, with areas of localized necrosis, and the subsequent exfoliation produces the foul masses. The granulating mucosa, robbed of its epithelial layers, becomes a connective tissue membrane from which all the leukocytic masses have been cast off. The inflammatory process is now at an end, and the resultant masses shrink slowly away from the membrane and more or less completely fill the lumen. These facts were all determined in experimental guinea pigs into whose antrums turpentine had been injected. In no instance did the normal ostium become occluded.

Mittermaier [25] discusses the various theories of edema in relation to p_H, alkalosis and acidosis and comes to the conclusions generally held

23. MacMahon, B. J.: Influence of Sulfanilamide on Infected Sinuses of Rabbits: Chemical and Microscopic Studies, Arch. Otolaryng. **28**:222 (Aug.) 1938.

24. Greifenstein: Spontane und experimentelle käsige Nebenhöhlenentzündungen beim Kaninchen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:251, 1938.

25. Mittermaier: Ueber Polyposis nasi und Ödembereitschaft, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:239, 1938.

in this country. He too recommends a salt-free diet, elimination of alkalis, increase of acids and proper attention to diet.

Brunner and Grabscheid [26] studied a series of 24 cases of Paget's disease, in 7 of which (29 per cent) there were roentgen evidences of involvement of the sinuses, particularly the sphenoid, frontal and ethmoid. Thorough study of postmortem serial sections in 1 case showed how the bony changes caused a narrowing of the lumen of the sinus through thickening of the bony walls, in some places to the point of obliteration. The author observes that the narrowing proceeds irregularly in various parts of the sinus, so that the lumen may be subdivided or displaced. It is naturally more active in the thick bones, since it proceeds from the blood vessels and the enveloping periosteum. He shows, however, that even the thin bones, such as the ethmoid septums, may be affected by a process beginning in the deepest layers of the mucosa in the same manner as it proceeds from the periosteum.

Walsh and Cannon,[27] on the basis of animal experimentation, clinical observation and postmortem examination, conclude that the "most suitable vehicle for intranasal medication is isotonic salt solution inasmuch as it causes no demonstrable interference with ciliary activity; whereas both hypotonic and hypertonic solutions cause definite harm to the cilia." Oils are unsuitable, because they block the normal flow of mucus and because the drugs dissolved in them do not penetrate the mucous blanket to reach the epithelium. The authors found a weak solution of ephedrine the most effective vasoconstrictor, because it causes no damage to the cilia. Mild protein silver has been proved experimentally to have no bactericidal effect. The authors report 3 cases of lipoid pneumonia resulting from the intranasal use of oils. They claim that their experiments on animals have demonstrated edema, alveolitis, focal lipoid pneumonia, granulomatous lesions, necrosis and bronchopneumonia occurring as a result of the aspiration of oily solution instilled intranasally.

Mood [28] reports a tumor near the inner canthus of the right eye in a child of 2, which had been present since birth and was tentatively diagnosed as a mucocele. Roentgenograms showed a defect in the floor

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26. Brunner, H.: Die Nebenhöhlen der Nase bei Ostitis deformans (Paget) des Schädels, Acta oto-laryng. **26**:174, 1938. Brunner, H., and Grabscheid, E.: Zur Kenntnis der Ostitis deformans (Paget) der Schädelbasis: II. Die vordere Schädelgrube mit besonderer Berücksichtigung der Nebenhöhlen der Nase, Virchows Arch. f. path. Anat. **301**:237, 1938.

27. Walsh, T. E., and Cannon, P. R.: The Problem of Intranasal Medication, Ann. Otol., Rhin. & Laryng. **47**:579 (Sept.) 1938.

28. Mood, G. F.: Congenital Anterior Herniations of the Brain, Ann. Otol., Rhin. & Laryng. **47**:391 (June) 1938.

of the frontal bone and the right nasal bone. At operation the tumor shelled out easily on the anterior and lateral aspects, but more deeply it was found to be continuous with the dura. When it was severed a free flow of cerebrospinal fluid persisted for eighteen days. Healing followed, with a deep scar. Histologic sections showed mucous fibrous tissue enclosing areas of glial tissue. Eighteen cases previously recorded in the literature were cited. The author believes that these tumors are true herniations, because of their appearance at the fontanels or suture lines of ununited cranial bones.

On the assumption that the ideal operation on the frontal sinus is one in which the cavity is obliterated by formation of new bone, Rossi [29] attempts to investigate the factors which may facilitate or retard such a process. Two series of animals were used; in one group the frontal sinuses were infected with gauze soaked with pus obtained from draining mastoids, and the other group were healthy controls. The sinuses were operated on and the entire mucosa removed by curettage. Subsequently the animals were killed and the skulls sectioned both horizontally and sagittally. The results showed that there was a greater tendency to formation of new bone in the healthy than in the diseased sinuses, as evidenced by formation of adventitious bony partitions and obliteration of recesses. In both groups the external periosteum showed a tendency to proliferation and the formation of a thick fibrous or fibro-osseous tissue. The author points out that there is less osteogenic activity in the suppurative than in the healthy sinuses and concludes that the hope of achieving obliteration of the sinus by curettement of the mucosa is false and that the procedure cannot obviate the danger of a relapse.

Karies and Koch [30] infected the frontal sinuses of cats with bacteria cultured from the animals' own throats and obtained reactions only when the duct was blocked by edema induced by the local application of lactic acid. Acute inflammation of the influenza type resulted. The bacterial strains isolated differed from those reported by Rivers and Bayne-Jones [31] in a similar series of experiments, which they termed parainfluenzal bacilli. The authors believe that the bacteria they found

29. Rossi, G.: Le modificazioni del seno frontale dopo raschiamento della mucosa (Ricerche sperimentali—considerazioni cliniche), Oto-rino-laring. ital. **8**:260 (June) 1938.

30. Karies, A., and Koch, J.: Die Erzeugung von Nebenhöhlenentzündungen bei Katzen mit spezieseigenen Bakterien aus der Gruppe der influenzabakterienähnlichen Pasteurellen, Arch. f. Hyg. **120**:180 (June) 1938.

31. Rivers, T. M.: Influenza-like Bacilli: Growth of Influenza-like Bacilli on Media Containing Only an Auto-Clave-Labile Substance as an Accessory Food Factor, Bull. Johns Hopkins Hosp. **33**:429 (Dec.) 1922. Rivers, T. M., and Bayne-Jones, S.: Influenza-like Bacilli Isolated from Cats, J. Exper. Med. **37**:131 (Feb.) 1923.

resembled those reported by Rimpau [32] and Kremsreiter,[33] which from cultural and serologic studies appear to be members of the group of pasteurellae. It seemed of importance to the authors that experimental production of infections with Pfeiffer bacillus similar to those occurring in human beings was possible in cats by the use of influenza-like bacteria recovered from the animals' own membranes.

Szende and Muranyi [34] made a study of the bacterial flora in 50 consecutive cases of maxillary sinusitis in an attempt to correlate these findings with observations of the clinical course. In 26 cases of acute sinusitis pneumococci and Diplococcus catarrhalis were found. The pneumococcic exudate was light yellow or green mucopus in clumps. The D. catarrhalis exudate was milky and cloudy. All the patients recovered after lavage except 4 with pneumococcic sinusitis, who recovered only after the instillation of antipneumococcus serum. Of 21 patients with chronic sinusitis 62 per cent showed streptococci, 33 per cent mixed bacteria and 1 patient the staphylococcus. The exudate in each case was grayish, turbid or milky. Twelve patients required surgical intervention.

DIAGNOSIS

Tomography, or the procedure of taking roentgenograms in a certain plane at a predetermined level, is attracting widespread interest, and more will be heard on this subject as the technic is acquired and the apparatus simplified. Di Rienzo and Boher [35] and Viana-Giuria and Apolo [36] contribute clinical studies which prove the superior value of this method over standard procedures. The former made studies of the sphenoid sinus in the frontal plane, and the pictures they submit demonstrate the configuration and outlines of the two sinuses, together with the position of the party wall, much more clearly than is possible by any other technic. Viana-Giuria and Apolo demonstrate the value of the procedure when carried out at different levels in the diagnosis of cysts of the maxilla, several illustrations of which are shown in the article. The point of origin and attachment of the growths is readily seen.

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32. Rimpau, W.: Ueber Infektionen des Menschen durch Haus- und Stalltiere, München. med. Wchnschr. **84**:413 (March 12) 1937.

33. Kremsreiter, J.: Menschenpathogene hämoglobinophile Bakterien in den Luftwegen einer gesunden Katze, Arch. f. Hyg. **118**:97 (May) 1937.

34. Szende, B., and Muranyi, L.: Bacteriology of Maxillary Sinusitis, Orvosi hetil. **82**:246 (March 12) 1938.

35. di Rienzo, S., and Boher, A.: Tomografia del seno esfenoidal normal, Día méd. **10**:134 (Feb. 21) 1938.

36. Viana-Giuria, G., and Apolo, E.: El valor de la tomografía en el estudio de algunos procesos patológicos del seno maxilar, Arch. urug. de med., cir y especialid. **12**:255 (March) 1938.

Rejto [37] made a study of 120 cases of sinal disease in which roentgenograms had been made with the idea of correlating these findings with the pathologic changes shown by the clinical course or by operation. In 40.8 per cent of the group, by far the largest percentage, unilateral involvement of the antrum and ethmoid sinuses appeared. In the diagnosis of acute conditions the author found that transillumination was of more value than roentgenograms, the results in 18 out of 23 cases being positive and confirmed by other findings. Of 113 patients with a chronic condition 81 were operated on, either by some radical procedure or by the intranasal approach to the ethmoid sinus, so that the sinuses were inspected and the degree of pathologic change ascertained. In 61 of these the condition was proved to be empyema; 4 had thickened mucosa, some with polyps. In only 2 cases was the roentgen diagnosis in error; in these the condition was given as involvement of the soft tissues but proved at operation to be a dental cyst overlying the antrum. The author calls attention to various points in the diagnosis of cysts, tumors and malignant conditions.

Stehr [38] prefers the upright position in taking roentgenograms of the sinuses because of better visualization of fluid levels. Errors in interpretation may arise from differences in the thickness of bone on the two sides, the presence of septums and differences in the angle of projection of the two zygomatic processes. Roentgenograms taken after fracture of the skull or injury to the face may show darkness or cloudiness of the antrum, due to filling with blood, which is dense enough to obscure the lines of the fracture. Special projections or repeated pictures may be necessary, especially in cases of fracture of the zygoma. The author points out that dental roentgenograms often show a tooth projecting into the antrum. In such a case the diagnosis must be confirmed by a sagittal film, because it is often a false interpretation due to the diagonal line of projection. If in doubt after a tooth has been pulled, he advises one should inject contrast medium to show the presence or absence of a fistula.

Barsony and Weiss [39] believe that errors in interpreting roentgenograms of the antrums and ethmoid sinuses are due to inaccurate centering. They stress the importance of having the dens epistrophei exactly in the midline in all posteroanterior projections.

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37. Rejto, G.: Clinical Value of Roentgen Examination of the Sinuses Based on Surgical Findings, Gyógyászat **77**:734 (Dec. 19) 1937.

38. Stehr, L.: Die Feststellung von Nasenhöhlenerkrankheiten durch die Röntgenuntersuchung, München. med. Wchnschr. **85**:1189 (Aug. 5) 1938.

39. Barsony, T., and Weiss, M.: Beitrag zur Analyse der projektionsbedingten Verdunkelungen der Nasennebenhöhlen, Röntgenpraxis **10**:5 (Jan.) 1938.

Portmann and Bonnafous [40] cite 2 cases in which identical symptoms, apparently originating in the frontal sinus, were present, the sinus being enormously pneumatized in 1 case and entirely absent in the other. The roentgenograms were certainly of great value. The authors point out that in a case in which the frontal sinus is undeveloped one finds the roof of the ethmoid sinus not only lower than when the frontal sinus is pneumatized but also placed diagonally, so that it seems as if the cranial cavity projects forward between the two orbits. This has always prompted their school to approach the frontal sinus at the point of juncture of the frontal, maxillary and nasal bones, as the approach least likely to carry any danger of accidental entrance into the cranial cavity.

Olaison [41] seeks some prognostic value in the study of the secretion obtained from sinuses by irrigation or aspiration. He claims that the bacterial flora are usually mixed, that staphylococci predominate and that odor is caused by Bacillus coli, proteus or pyocyaneus. No diagnostic criteria can be based on the first few irrigations, since the character changes rapidly except in cases in which the condition is likely to become chronic; in these cases observation of the type of secretion may indicate the necessity for operation. The fine distinctions which the author makes are not very convincing except for the well known and often stated fact that the more mucoid the secretion the better the prognosis.

Ridpath [42] gives a good discussion of the differential diagnosis of various sinal conditions, covering most of the accepted data in good order and as completely as the limits of the paper will permit. The significance of local and referred pain is thoroughly stressed and the differential diagnosis of frontal sinusitis from supraorbital neuralgia, tuberculosis, syphilis and tumor is clearly given. The same may be said of his discussion of pains originating in a diseased sphenoid sinus.

Among the cases cited by Northington [43] was 1 in which a diagnosis of a tumor of the right orbit had been made. Analysis showed the true condition to be retrobulbar neuritis due to sinusitis. The symptoms were loss of light perception, restriction of bulbar movements, absence of intraocular disease and roentgen evidence of erosion of the greater wing of the sphenoid. Pus was found in the nose. The antrum, the

40. Portmann, G., and Bonnafous: Considérations anatomiques sur le développement des sinus frontaux, Oto-rhino-laryng. internat. **22**:136 (March) 1938.

41. Olaison, F.: Prognostic Value of the Study of Pus in Sinus Infections, Nord. med. tidskr. **14**:2073 (Dec. 18) 1937.

42. Ridpath, R. F.: Diagnosis and Differential Diagnosis of Accessory Sinus Disease, M. Clin. North America **22**:1591 (Nov.) 1938.

43. Northington, P.: Some Cases of Otolaryngological Interest That Were Seen on the Neurological Service, Laryngoscope **48**:1 (Jan.) 1938.

ethmoid and the sphenoid sinus were opened, and mucopus under pressure was evacuated. Vision returned promptly. In the second case there was swelling of the lids, headache and fever for ten days. The sinuses were suspected and were treated with packs of mild protein silver. Swelling of the lids persisted; conjunctivitis appeared; there was no disturbance of vision, no proptosis and no limitation of bulbar movements. The sinuses were clear, and no pus was recovered. A blood count revealed eosinophils up to 33 per cent. A further search disclosed trichinosis. In a third case the patient complained of persisting headache two months after a depressed frontal fracture. Observations at neurologic examination were negative except for slight changes in personality. The temperature was 102 F. It seemed that an intracranial complication might be developing. The frontal sinus was opened and some fragments of depressed bone removed. No infection was found. Two weeks later a 4 plus Wassermann reaction was recorded. The patient responded to antisyphilitic treatment.

SINUSITIS IN CHILDREN

Crooks [44] presents a good clinical evaluation of a series of 100 cases of sinusitis in children. In 24 cases the tonsils and adenoids were removed because of the presence of mucopus in the antrums. The patients were followed up, and after six months it was found that in 16 the sinal condition still persisted. The following symptoms were most commonly listed: nasal or postnasal discharge, in 84 cases; frequent colds, in 83; cough, in 82; mouth breathing, in 62; headache, in 44, and otitis media, in 44. Diagnosis is made by transillumination, roentgenograms and direct puncture. A sterile needle is inserted through the trocar to avoid contamination and the contents of the sinus aspirated for culture. The predominating bacteria were pneumococci and streptococci. The author irrigates the antrum, and if after six irrigations the condition is still present he does an intranasal antrotomy. Of his 100 patients, 52 were cured, 32 improved and 16 unchanged.

Bowen-Davies' [45] findings, in 55 patients of from 5 to 14 years of age, do not agree exactly with the previous author's. He found staphylococci more frequently than pneumococci or streptococci. He also aspirated under aseptic conditions, centrifuged and planted his material in blood agar for culture. The bacteriologic findings did not coincide with his roentgen findings. Of 110 antrums 66 appeared infected on roentgen examination, yet only 27 yielded a positive culture, the culture from 39 remaining sterile. His studies of the evacuation of iodized

44. Crooks, J.: Nasal Sinusitis in Childhood, Brit. M. J. **1**:935 (April 30) 1938.

45. Bowen-Davies, A.: The Paranasal Sinuses in Children, Proc. Roy. Soc. Med. **31**:1411 (Oct.) 1938.

poppyseed oil from the antrums showed that in the cases in which the culture was sterile it took an average of seventeen and nine-tenths days for complete evacuation whereas in the cases of infection the average time was fourteen and nine-tenths days (due to the reduced capacity of the sinus, according to the author). He asserts:

> The rapid evacuation of lipiodol does, however, prove that the function of the cilia is not affected by infection as we have been led to believe. It is a well-established fact that an infected antrum may be cured by drainage, and it follows that by providing free drainage we are doing what Nature has already been doing fairly efficiently.

He believes that many of his good results were due to the beneficial effect of the iodized poppyseed oil.

Strachan [46] also favors proof puncture in children for diagnosis and for cultures. Reporting from the Toronto Hospital for Sick Children for 1936-1937, he indicates that surgical intervention is not required as frequently as many believe. Lavage of the antrum was done in 184 cases, antrostomy in 8 and reduction of the middle turbinate or curettement of the ethmoid sinuses in 29.

Fabinyi [47] believes that the spread of sinusitis in children is due to thinness of the dividing walls, marked vascularity of the tissues, rich communication between the blood vessels of the bone and the periosteum and the lack of fusion of suture lines. Naturally stasis is favored by adenoids and swollen nasal mucosa. The author favors the use of a nasopharyngoscope in the diagnosis of the source of the discharge. He reports 66 cases of sinusitis occurring in infectious diseases, scarlet fever accounting for 8 per cent of the total. In 21 cases the condition was complicated with orbital infection, which seems a rather high percentage. In 38 per cent of the cases of orbital infection it was further complicated by bilateral mastoiditis. All the patients with otitis had large tonsils and adenoids. In the treatment of the orbital infections the author first tried infracting the middle turbinate or amputating the anterior end if it was obstructing. If polyps were present they were removed with small forceps. If this was insufficient he made an external opening. Most of the scarlatinal infections appeared in the first week of the disease, and the early treatment consisted of tampons with ephedrine, inhalations of steam, suction and instillation of mild protein silver.

Ebbs [48] examined the sinuses at autopsy in 496 children up to the age of 14, who died from a great variety of medical and surgical con-

46. Strachan, J. G.: Chronic Sinusitis in Children, Bull. Acad. Med., Toronto **12**:11 (Oct.) 1938.

47. Fabinyi, G.: Inflammations of the Paranasal Sinuses of Children, with Special Reference to Acute Infectious Diseases, Orvosi hetil. **81**:1219 (Dec. 4) 1937.

48. Ebbs, J. H.: A Note on the Incidence of Sinusitis in Children, Brit. M. J. **1**:385 (Feb. 19) 1938.

ditions, and found a purulent infection in one or more sinuses in 152, or 30.6 per cent. The incidence was higher in children under 2 years of age than in those over 2 years. The vast majority of the infections were found in the antrum. In 78.2 per cent of the cases of sinusitis there was associated otitis media, which corroborates Collom's findings of several years ago.

The entire subject is covered in a symposium before the Medical Association of Puerto Rico by Ortíz for the pediatrician, Font for the larynygologist, Landron for the radiologist and Morales for the neurologist.[49] Ortíz claims that sinusitis is much more frequent than supposed and must be considered in the etiology of such conditions as arthritis, neuritis, impaired nutrition, bronchial asthma, allergy and urticaria, pains in the head, retrobulbar neuritis, repeated attacks of otitis media, cervical adenitis and orbital conditions.

In connection with orbital abscess Fitz-Hugh [50] advises not only an external incision to liberate the pus but also removal of "part of the lamina [papyracea], enough of the ethmoids, and if necessary a portion of the floor of the frontal sinus near its inner angle to enable us to place a rubber tube drain down into the nose." This seems a bit more radical than the usually accepted practice in acute conditions. In a series of 30 cases in which orbital symptoms occurred he found 9 cases of orbital abscess and 2 of abscess of the brain and meningitis. In the 30 cases 24 patients were treated surgically, 9 by major procedures.

On the basis of history, roentgen findings and transillumination, Bettington [51] advises "proof-puncture" for children, under general anesthesia, to determine the presence of pus. If the result is positive he follows immediately with a window into the antrum, using a punch forceps rather than a rasp, and the insertion of a rubber tube for drainage.

McLendon [52] believes that roentgen rays have some value in the treatment of sinusitis in children and attributes the beneficial results to the release of antibodies from the destruction of polyps and eosinophils. He also asserts that the macrophages take on increased phagocytic activity. Of 48 cases in which this treatment was used he records cures

49. Ortíz, A.: Las sinusitis en los niños: Aspectos pediátricos, Bol. Asoc. méd. de Puerto Rico **30**:319 (Sept.) 1938. Font, J. H.: Las sinusitis en los niños: Puntos de vista del otorrinolaringólogo, ibid. **30**:326 (Sept.) 1938. Landrón, J.: Las sinusitis en los niños: Diagnóstico radiológic, ibid. **30**:330 (Sept.) 1938. Morales, L. M.: Las sinusitis en los niños: Complicationes neurológicas y psiquiátricas, ibid. **30**:337 (Sept.) 1938.

50. Fitz-Hugh, G. S.: Acute Sinusitis in Children, Virginia M. Monthly **65**: 251 (May) 1938.

51. Bettington, R. H.: Some Aspects of Maxillary Antrum Infection, M. J. Australia **1**:853 (May 14) 1938.

52. McLendon, P. A.: Chronic Sinusitis in Children, with Special Reference to X-Ray Therapy, M. Ann. District of Columbia **7**:341 (Nov.) 1938.

in 35 per cent, improvement in 41 per cent and the condition unchanged in only 10 per cent. An analysis of 76 cases of chronic sinusitis, in which the patients ranged in age from 6 months to 12 years, revealed only 14 in which positive clinical or hereditary signs of allergy occurred and 4 in which the reaction was positive to cutaneous tests. Roentgen examination of the chest showed signs of sinobronchitis in 22 cases.

Le Mee and Richier [53] maintain that the Proetz position fails in 20 to 25 per cent of cases in which the maxillary sinus is concerned. They propose a new position by which all the sinuses on one side can be filled, with the exception of the frontal. The patient lies on the side with a rolled sheet or small round cushion at the neck. Two maneuvers are described: (1) flexion of the head to 20 to 30 degrees and (2) rotation of 20 to 30 degrees toward the uppermost side, i. e., the side away from that whose sinuses are to be filled. In this position the lateral nasal wall is in a plane which can be completely covered by the instilled oil. They assert that the Parkinson head-low position is not favorable for displacement. Lateral flexion to 45 degrees is too far to permit bathing the middle meatus completely in the oil, which tends too much to the posterior ethmoid and sphenoid sinuses at the expense of the anterior ethmoid sinuses and the antrum. The authors performed 440 instillations by this method in a period of twenty months. In a series of 40 cases the procedure was checked by roentgenograms, which showed adequate filling in 100 per cent of the ethmoid sinuses, 92 per cent of the antrums and 27 per cent of the frontal sinuses. Incidently 35 of the 40 patients were cured by one instillation of iodized poppyseed oil 25 per cent. In all the cases instillation was preceded by one lavage and by adequate shrinkage. The negative pressure used was 10 to 12 mm. of mercury and the average quantity of oil 5 cc.

Faier [54] finds the Proetz position satisfactory for displacement therapy and for acute cases used a 0.25 per cent solution of ephedrine in physiologic solution of sodium chloride.

Morgan [55] lists stuffy nose, pyrexia, mucopurulent discharge and loose cough as symptoms of sinusitis in children, particularly when following an attack of influenza. Chronic sinusitis is more likely to develop in a child debilitated by illness and malnutrition than is the sinal disease to cause the general debility. He believes that the term "broncho-sinusitis," coined by Wasson, expresses the true sequence. Atelectasis

53. Le Mee, J. M., and Richier, J.: La "position latérale" en méthode de déplacement: Nouvelle technique et résultats thérapeutiques, Bull. Soc. belge d'otol., rhin., laryng., 1938, p. 64.

54. Faier, S. Z.: Paranasal Sinus Disease in Children, Nebraska M. J. **23**: 370 (Oct.) 1938.

55. Morgan, B.: The Relation of Ear, Nose and Throat to the Diseases of Children, J. Laryng. & Otol. **52**:855 (Dec.) 1937.

is a common precursor of bronchiectasis, and the vicious circle of sinus and bronchus is then established.

Monti [56] finds transillumination and roentgen rays unsatisfactory as diagnostic mediums for children under 5 years. He places more reliance on Proetz displacement with radiopaque fluid and diagnostic puncture.

Creasy [57] presents his results with 60 children, aged 5 years to 14, with asthmatic syndrome associated with sinal trouble. The treatment followed was careful conservative surgical intervention, such as reduction of spurs and ridges, collapsing of cystic turbinates, intranasal antrotomy and removal of tonsils and adenoids. Twenty per cent were definitely improved for one to two years or more, and 55 per cent were symptom free for 1 to 2 months. The chief desiderata in his opinion are ventilation and drainage.

Iwamoto [58] reports a case in which osteomyelitis of the maxilla in an infant 11 days old began with high fever, exophthalmos and swelling of the cheek. Later a fistula was found at the external angle of the orbit. There was a foul nasal discharge, and eventually the alveolar process necrosed, along with part of the anterior wall of the sinus. Removal of a large sequestrum was followed by recovery. The process lasted over a year.

A similar case, of a child of 3½ years, is recorded by Matsushita.[59] The onset was sudden, with a high temperature (40 C. [104 F.]), followed by swelling of the cheek and redness. Two weeks later a fistula appeared in the alveolar region anterior to the premolar. Three months later a sequestrum was removed, and recovery ensued after some delay. In Uryu's [60] case the condition began similarly in a child of 2½ years. The infraorbital swelling was incised and drained slowly for several months. Increased swelling of the cheek and intranasal obstruction eventually led to a Caldwell-Luc operation. The sinus was found to be filled with polyps and cheesy debris, and the mucosa was degenerated, soft and polypoid. Streptococci and staphylococci were found. Recovery followed after about seventeen days.

Krakovits [61] reports 2 cases of severe infection of the antrum and the ethmoid sinus with sepsis in infants, 2 and 8 months old. One patient

56. Monti, P. C.: Le malattie dei seni nasali nel bambino, Boll. d. mal. d. orecchio, d. gola, d. naso **56**:121 (April) 1938.

57. Creasy, R. C.: The Role That Surgery of the Paranasal Sinuses Plays in the Asthmatic Child, Laryngoscope **48**:415 (June) 1938.

58. Iwamoto, Y.: Ein Fall von Sinuitis maxillaris neonatorum mit deren Residuen, Oto-rhino-laryng. **11**:429 (May) 1938.

59. Matsushita, H.: Ein Fall von Sinuitis maxillaris neonatorum, Oto-rhino-laryng. **10**:1111 (Dec.) 1937.

60. Uryu, E.: Sinuitis maxillaris caseosa im Anschluss an akute Kieferhöhlenentzündung bei einem Kinde, Oto-rhino-laryng. **11**:425 (May) 1938.

61. Krakovits, M.: Sinus Inflammation in Infants, Gyógyászat **77**:730 (Dec. 19) 1937.

recovered after prompt radical operation on the antrum, although the course was prolonged by complications, such as bilateral otitis media, metastatic abscesses and renal infection. The other patient died. From the description in both cases it would appear that there must have been some osteomyelitis of the maxilla, although mention of a sequestrum is lacking.

From Rumania [62] comes a report of 2 cases of severe acute ethmoiditis with orbital complications in young children; in 1 the condition was due to grip and in the other to scarlet fever. In both cases external incision was employed, as well as intranasal drainage by simple infraction of the middle turbinate. As a rule the author advises conservative medical treatment unless there is evidence of orbital abscess or intracranial complications.

SINUSES IN RELATION TO DISEASES OF OTHER ORGANS

Babbitt[63] discusses otorhinolaryngologic conditions that may arise in the course of various systemic disorders, emphasizing in bold type the salient features in each case. For instance, under pneumonia he says, "keep watch of sinus and middle ear disease"; under typhoid fever, "observe the sluggish nonresistant mucous surface; keep clean and guard ulcerative areas"; under influenza, "treat the sinuses and the ear may clear up rapidly," and under diabetes, "suspect a rhinitis of being the systemic accompaniment in diabetes." Specialists need to read an article of this sort from time to time in order to get the picture of the patient as a whole.

Pulmonary Diseases.—Kecht [64] urges careful examination of the sinuses for all pulmonary conditions that resist treatment, and when a pathologic change is found he advises radical treatment. He cites several cases that illustrate the point. Chronic bronchitis in a man of 22 that failed to yield to the usual treatment was cured when an acute exacerbation of chronic maxillary sinusitis of dental origin was discovered and eradicated. In a case of pneumonia with pleural exudate concurrent bilateral pansinusitis with a secondary orbital abscess was revealed; the condition resolved promptly after surgical treatment of the sinuses. In a third case a man of 43 had a productive cough with a foul secretion of several weeks' duration which was traced to old purulent sinusitis. Pneumothorax developed, necessitating resection

62. Vaida-Voevod, A.: Acute Complicated Ethmoiditis in Children, Cluj. med. **19**:236 (April 1) 1938.

63. Babbitt, J. A.: Systemic Diseases Causing Inflammation in the Ear, Nose and Throat and the Local Management of These Conditions, M. Clin. North America **22**:1645 (Nov.) 1938.

64. Kecht, B.: Lungenerkrankungen und Nasennebenhöhleneiterungen, Wien. med. Wchnschr. **87**:1219 (Nov. 20) 1937.

of a rib. Death ensued from cardiac insufficiency. Autopsy revealed empyema of the left frontal and maxillary sinuses. In the fourth case exudative pleuritis and empyema which ensued two weeks after a bilateral Lothrop operation yielded to thoracentesis. The author is of the opinion that the infection was by direct aspiration rather than lymphogenous, although he admits the possibility of infarcts occurring in remote areas of the lung via the venous channels.

Watson and Kibler,[65] analyzing a number of cases of patients with bronchiectasis sent to Arizona for the climate, found fully 90 per cent of them to be definitely allergic on the basis of a high eosinophil count in the secretions, associated hay fever or eczema and consistently positive cutaneous tests. They divide bronchiectasis into three types: (1) congenital bronchiectasis, (2) mechanical bronchiectasis, as from tuberculosis, fibrous pleurisy or pulmonary fibrosis, and (3) allergic bronchiectasis. The cases, which they studied by the usual means, including roentgen studies with iodized oil, fell into four groups: (1) cases in which a diagnosis of bronchiectasis was made elsewhere because of chronic cough when roentgenograms failed to reveal bronchial dilatation but in which every evidence of allergy appeared, (2) cases like the foregoing instance, in which slight dilatation of the bronchioles was apparent, (3) cases in which more marked dilatation occurred and (4) cases of advanced bronchiectasis, with marked pocketing. They feel that if the allergic causation were recognized and the allergy treated early enough the irremediable pathologic changes of the late condition could in many instances be prevented.

A careful analysis of 75 cases of bronchiectasis by Goodale [66] reveals some interesting facts. In 65 per cent of the cases the condition had existed for five years or more, and the relation to sinusitis was therefore difficult to determine. In 32 cases the pulmonary condition was attributed to a preceding infection of the upper part of the respiratory tract, and in 20 cases the cause was definitely pneumonia. Roentgen evidence of sinusitis was found in 69 per cent of the cases of involvement of the respiratory tract and 57 per cent of those in which the lungs were affected. Another interesting observation is the possible development of sinusitis during the course of the bronchiectasis due to lowered resistance of the patient and greater susceptibility to colds. However, the author wisely points out that whether the sinusitis exists before the bronchiectasis or develops later it may be a factor in its resistance to treatment and therefore deserves adequate and thorough treatment.

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65. Watson, S. H., and Kibler, C. S.: Bronchiectasis: A New Conception of Its Etiology Which Makes Prevention and Recovery Possible, J. A. M. A. **111**:394 (July 30) 1938.

66. Goodale, R. L.: An Analysis of Seventy-Five Cases of Bronchiectasis from the Viewpoint of Sinus Infection, Ann. Otol., Rhin. & Laryng. **47**:347 (June) 1938.

Walsh and Meyer [67] also found sinal disease in association with bronchiectasis in 66.8 per cent of 217 cases. They note that most of the patients had few subjective symptoms of the sinusitis. They believe the association of the two conditions is more than coincidental and attribute the bronchial condition to aspiration of infected material on the basis of their observation that iodized oil instilled into the nasal cavities of sleeping subjects may be demonstrated in the bronchi and alveoli by roentgenograms. In the series cited the authors found the two conditions more frequently in younger patients.

Veneziale's [68] statistics closely parallel those of the two previous authors, although the number of cases observed was smaller. He found association with sinusitis in 73 per cent of 26 cases of bilateral bronchiectasis. References to Jackson, Tucker and Clerf show that the author has followed these authors with good results.

Adams and Churchill [69] observe that situs inversus is a fairly frequent finding in bronchiectasis. The records of the Massachusetts General Hospital since 1886 show a total of 712 cases of bronchiectasis. During the same period there were 23 patients with situs inversus, 21.7 per cent of whom had bronchiectasis. This is in contrast to an incidence of 0.306 per cent of bronchiectasis in the total hospital population. The authors found associated sinusitis in 90 per cent of all of their cases of bronchiectasis, although they are not willing to admit the etiologic sequence in all instances. They state that the triad of situs inversus, bronchiectasis and sinusitis is sufficiently common to suggest a common etiologic heriditary makeup. Five typical cases are cited.

Butler [70] believes that the posterior sinuses have frequently been overlooked as a cause of nontuberculous pulmonary conditions, particularly in children. This is because the symptoms are not as well defined as those arising from disease of the anterior sinuses. In his opinion the infection more frequently takes place by aspiration of infected material than by way of the lymphatics, and he looks on postnasal discharge and a dry glistening posterior pharyngeal wall as significant symptoms.

Moatti [71] cites 3 cases in which asthma of several years' duration was cured by radical operation on the maxillary sinuses. In every instance the sinal mucosa was found degenerated and polypoid. In

67. Walsh, T. W., and Meyer, O. O.: Coexistence of Bronchiectasis and Sinusitis, Arch. Int. Med. **61**:890 (June) 1938.

68. Veneziale, A.: La broncoscopia nella diagnosi e nella cura delle bronchiectasie: Relazione fra le infezioni delle cavità accessorie del naso e le bronchiectasie, Riforma med. **54**:302 (Feb. 26) 1938.

69. Adams, R., and Churchill, E. D.: Situs Inversus, Sinusitis, Bronchiectasis: Report of Five Cases, Including Frequency Statistics, J. Thoracic Surg. **7**:206 (Dec.) 1937.

70. Butler, H.: Chest Conditions Secondary to Empyema of the Posterior Para-Nasal Sinuses, Maine M. J. **29**:30 (Feb.) 1938.

71. Moatti: Asthme et sinusite, Tunisie méd. **32**:147 (April) 1938.

1 case, the condition was due to a previous dental infection, and after the sinal operation the asthma recurred. The persistence of a fistula led to a second operation, which disclosed a large area of osteitis, involving the floor of the sinus and the external table of the adjoining alveolar process. The author asserts that many such conditions are overlooked, because transillumination and roentgenograms may be misleading. He places great reliance on the use of contrast mediums in the sinuses as a means of determining the true state of the lining mucosa.

Whelan [72] reviews the work of Treves, Andre, Gruenwald and some of the older anatomists, as well as the more recent contributions by Mullin, Moore, Lukens, Clerf and Fenton, relative to the pathways of infection from the sinuses to the lower respiratory tract. He feels that aspiration is the more frequent pathway and testifies to the lasting benefits of a radical sinal operation in several cases in which the sinal condition was more or less dormant.

Nelson [73] calls attention to cases in which a condition tentatively diagnosed as pulmonary tuberculosis proved to be primarily chronic sinusitis, with secondary bronchitis and enlargement of the peribronchial and mediastinal glands. Aside from the usual findings in the nose, the author points out that tuberculosis can be excluded by a negative Mantoux reaction with injection of up to 1 mg. of old tuberculin, negative reaction of the sputum and the more rapid sedimentation in sinusitis than in tuberculosis.

Brock and Bell [74] present an interesting analysis of 306 consecutive admissions to the Waverly Hills Sanitarium during the course of a year. The sinuses are routinely examined by roentgen rays in every case on admission. Two hundred and fifty-three of the patients had uncomplicated tuberculosis, and of this group 40 per cent gave evidence of some sinal involvement. There were 44 patients with bronchiectasis, nearly all of whom had sinal disease, and in some of the cases the bronchiectasis was not diagnosed until after the sinusitis had been uncovered. The authors considered it significant that whereas the bronchiectatic patients showed extensive sinal involvement the patients with tracheobronchitis gave little evidence of advanced sinusitis. They maintain that the latter group are potential victims of bronchiectasis and that it is therefore important to clear up the existing sinal condition, no matter how insignificant, as a prophylactic measure. They state further that patients with tuberculosis are more susceptible to sinal disease than normal

72. Whelan, G. L.: Relation of Nasal Sinus Infection to Involvement of the Lower Respiratory Tract, Pennsylvania M. J. **41**:287 (Jan.) 1938.

73. Nelson, J. E.: Sinusitis with Its Complications Simulating Tuberculosis, Dis. of Chest **4**:57 (June) 1938.

74. Brock, B. L., and Bell, J. C.: Disease of the Accessory Nasal Sinuses: Its Incidence in a Tuberculosis Sanitarium, Am. Rev. Tuberc. **38**:312 (Sept.) 1938.

subjects but that "the *amount* of pulmonary tuberculosis *per se* has little or no influence upon the *incidence* or upon the *amount* of sinus disease in any given group."

Donaldson and Bachman [75] suggest the value of roentgenoscopic examination as a routine procedure in all cases of pneumonia for the diagnosis of coexisting suppurative antritis. They observed 2 cases in a series of 38 cases of pneumonia in which the condition was confirmed by puncture and lavage. They also believe in forcing fluids in these cases, having given up to 7,000 cc. per day in 1 instance.

Arthritis.—McCollom's [76] report is based on a study of 110 cases of rheumatoid arthritis observed at the Faulkner Arthritis Clinic of Columbia. In discussing the diagnosis of the condition he mentions the high sedimentation rate (up to 110 mm. per hour), the agglutination of streptococci (40 to 70 per cent) and the low values for antistreptolysin. Only 26 per cent of the group having no history of previous sinusitis showed cloudy antrums, the treatment of which seemed to affect the status of the joints. In a group of 12 cases in which sinusitis was known to be present, 6 patients (50 per cent) showed definite improvement following treatment. The author finds on the evidence of this series that a definite connection between the sinus and the disease of the joints could be proved in comparatively few cases. He makes a plea to "establish the diagnosis of the type of arthritis before proceeding too rapidly with attempts to eradicate foci and claiming cures from therapy."

Nervous and Mental Diseases.—Two cases of isolated paresis of the abducens nerve due to polypoid ethmoiditis are cited by Diamant.[77] In both instances the condition was relieved by operation on the sinuses. He attributes the complication to an unusual extension of the ethmoid sinuses posteriorly into the orbit.

Since Graves [78] published his report in 1932 on 1,000 cases of mental disease, with a large proportion of sinal disease, followed by Pickworth's [79] monograph on the same subject, much speculation has been rife as to whether one should not seriously consider the sinuses as common portals of entry for toxins causing mental disturbances or

75. Donaldson, B. F., and Bachman, A.: Maxillary Sinusitis Associated with Pneumonia as Seen in the Winter of 1936, Am. J. Roentgenol. **39**:202 (Feb.) 1938.

76. McCollom, R. L.: The Tonsils and Sinuses in Rheumatoid Arthritis, Laryngoscope **48**:314 (May) 1938.

77. Diamant, M.: Les parésies isolées du nerf moteur oculaire externe, Acta oto-laryng. **25**:550, 1937.

78. Graves, T. C.: Sphenoidal Sinus Disease in Mental Disorder, Proc. Roy. Soc. Med. **27**:1515 (Sept.) 1934.

79. Pickworth, F. A.: Pathology of the Nasal Sinuses and Its Relation to Mental Disorder, J. Ment. Sc. **78**:653 (July) 1932.

as foci for the same. Smith and Ross [80] made an investigation of 818 patients with mental disorder at the Royal Edinburgh Hospital and found that only 12 per cent showed any evidence of sinal involvement. Since this is not much larger than the incidence of sinusitis in the average control group, the authors do not feel that Graves and Pickworth's findings can be corroborated. They state further that in a group of 16 patients on whom a sinal operation was indicated on the basis of definite objective findings, only 1 patient showed any improvement in the mental condition following operation, the improvement being only temporary.

OSTEOMYELITIS

Levene and his associates [81] studied 6,000 skulls and divided them into four groups according to the degree of bony development, extent of pneumatic cells, and expansion of the diploe. In type 1, the diploe are expanded and vascular. Both inner and outer tables are thin. The vault is thick but of light construction. Typical of this condition is acromegaly. In type 2, there is postadolescent or acquired deficiency of the anterior lobe of the pituitary gland and absence of diploetic expansion. The sinuses and mastoid are poorly developed, and the skull is dense and hard. This type is frequently associated with obesity. In type 3, there is overactivity of the anterior lobe followed later by hypofunction. The diploe are expanded and the sinuses hyperpneumatized. Secondary sclerosis begins in the inner table, extending into the diploe. There are patches of calcium deposits and the changes are most marked in the frontal bone. In type 4, there is a congenital or preadolescent deficiency of the anterior lobe, producing the type called "pituitary dwarf." The findings are similar to those in type 2: poor pneumatization, patent sutures, dentition delayed, small face and jaws. Thus the authors attempt to show that the structure of the bones of the skull is influenced by the degree of activity of the anterior lobe of the pituitary gland and that the incidence of osteomyelitis is dependent on the type of cranial bone, particularly the degree of expansion and vascularity of the diploe. Therefore one may expect to find a greater predisposition to osteomyelitis with types 1 and 3.

Sitsen [82] records his microscopic findings in 11 cases of osteomyelitis in some of which the condition was metastatic from undetermined or previously healed foci. Expansion of the disease is by way of the veins, but destruction is due to occlusion of the afferent arteries. He

80. Smith, A. B., and Ross, C. M.: Nasal Sinusitis and Mental Disorder: Survey of Eight Hundred and Eighteen Cases, Edinburgh M. J. **45**:343 (May) 1938.

81. Levene, G.; Johnson, L. F.; Lowman, R. M., and Wissing, E. G.: The Role of the Hypophysis in Cranial Osteomyelitis, Petrositis and Sinus Infections, Endocrinology **22**:521 (May) 1938.

82. Sitsen, A. E.: Ueber die Osteomyelitis der Schädelknochen, Monatschr. f. Ohrenh. **72**:729 (Aug.) 1938.

differentiates two types anatomically. One is the exudative or purulent type, with necrosis, and the other is the productive type, which often develops from the former and which is characterized by increased apposition and destruction of bony substance. The diploe withstand the process longer than the tables. New bone may be formed and enclose small sequestrums. The disease spreads more rapidly along the surfaces, internal as well as external, than by way of the diploe, which accounts for the appearance of extradural abscess beyond the area of palpably diseased bone.

Pastore and Williams [83] report a case in which osteomyelitis in a girl of 18 was due to swimming. The diagnosis was made in the fifth week, and the area was exposed by a coronal incision through the scalp, the soft tissues being reflected forward so that the entire frontal area was exposed. The bone was removed down to the supraorbital ridge. A fistula in the dura was found and cauterized. The posterior walls of both frontal sinuses were removed, the frontal and ethmoid sinuses cleaned out and drainage into the nose established by the Lothrop method. Rosenow's concentrated antistreptococcus serums 261 and 262 were diluted, mixed and poured freely into the wound. Specific antivirus was made from the organism recovered and used later in conjunction with transfusions and sulfanilamide therapy. Recovery ensued. The report is interesting because of the type of incision used and the approach to the sinuses.

Mygind [84] describes the same incision and states that the advantages in its favor are better opportunity for inspection of both the frontal and part of the parietal bone, access to the roof of the orbit and the cribriform plate, easy approach to the frontal and ethmoid sinuses from above and absence of visible scar and deformity. The incision is made just within the hair line, from a point slightly above and in front of the auricle. It goes clear through to the bone. Few large vessels are encountered. The scalp is reflected forward over the face as far down as the supraorbital ridge. When the operation is concluded the scalp is sutured back in place, drainage being provided for by tubes or flat drains at the angles of the brow. Diluted solution of sodium hypochlorite is used until drainage lessens. Nine patients were treated thus, all but 1 of whom recovered. Five of the patients had an extradural abscess, 6 had cells in the spinal fluid and 1 had an abscess of the brain.

Hennebert and Schuermans [85] also recommend the coronal incision, and they report 2 cases. In 1 case, that of a man of 40, the infection

83. Pastore, P. N., and Williams, H. L.: Osteomyelitis of the Frontal Bone Secondary to Suppurative Disease in the Frontal Sinus: Report of a Case, Proc. Staff Meet., Mayo Clin. **13**:7 (Jan. 5) 1938.

84. Mygind, S. H.: Herunterklappen des Skalps bei Ostitis frontis, Acta otolaryng. **26**:537, 1938.

85. Hennebert, P., and Schuermans, J.: Deux cas d' ostéite du frontal, Bull. Soc. belge d'otol., rhin., laryng., 1937, p. 275.

occurred several years after an apparently successful Denker operation and intranasal ethmoidectomy, beginning in the superior maxilla and ethmoid and spreading from there to the frontal bone and the base of the skull. The patient died of meningitis. In the other case the condition followed acute pansinusitis in a woman of 24. The offending organism was a staphylococcus.

In Hill's[86] case, that of a girl of 14, the infection started with acute frontoethmoiditis following swimming. Metastases appeared in the wrist, coccyx and lung at an early period, and despite extensive operative procedures death ensued one hundred and thirteen days after resection of the frontal bones. Abscesses of the frontal lobe were present on both sides. In another case reported by the same author a woman of 30, in whom the condition followed an orbital abscess, recovered.

McKinney[87] submits the histories of 8 patients, with 3 deaths. The general plan followed was extensive resection of bone and adequate drainage. He found roentgenograms occasionally misleading, since bone macroscopically healthy was often shown to be affected. The author believes that many patients with chronic sinusitis may show slow osteomyelitic changes.

Apffelstaedt[88] reports 7 cases, with 6 cures, most of them following acute sinusitis. He attributes his good results to early radical operation, with removal of both plates of the bone far into healthy areas. The exposure in most instances was by the Killian incision with extension in the median line. Although negative roentgenographic evidence is not conclusive he advises that roentgenograms should be taken frequently, in conjunction with blood counts, because these measures often give warning of extension.

In 3 cases reported by Hargrove[89] all the patients were children, aged 9, 10 and 11. In 2 of the cases some intranasal surgical measures preceded the onset of the osteomyelitis; 1 of the patients died of an abscess of the brain. One wonders whether intranasal surgical intervention for these acute conditions is well advised.

Ramírez Corría's[90] case was interesting because of the history of recent trauma over an area traumatized twenty-five years previously without apparent ill effects. Operation disclosed a large portion of

86. Hill, F. T.: Osteomyelitis of the Skull, Maine M. J. **29**:23 (Feb.) 1938.

87. McKinney, R.: Osteomyelitis of the Frontal Bone: Report of Eight Cases, Arch. Otolaryng. **28**:1 (July) 1938.

88. Apffelstaedt, O.: Beitrag zum Krankheitsbilde der Osteomyelitis cranii rhinogenen Ursprungs, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **144**:315, 1938.

89. Hargrove, R. M.: Osteomyelitis of the Frontal Bones, Complicating Frontal Sinusitis, Texas State J. Med. **33**:767 (March) 1938.

90. Ramírez Corría, C.: Osteomielitis frontal con secuestro y absceso cerebral encapsulado por antiguo trauma "renovado," Cir. ortop. y traumatol., Habana **5**:266 (Oct.-Dec.) 1937.

diseased frontal bone covering a thick fungoid area of the dura, which the author destroyed by electrocoagulation. One month later, the symptoms recurred, and a second operation disclosed an encapsulated abscess of the brain. The author believes that the granuloma which resulted from the ancient trauma was infected by way of the blood stream after the recent trauma and offers some data from animal experiments to show that infection of sterile granulomas by way of the blood stream is possible after irritation by slight trauma. The encapsulated abscess of the brain was extirpated completely; the author credits "Dr. Vincent" with the idea, although the exact reference is not given.

Lewis [91] reports 3 cases. In 1 the condition followed a cold in a woman of 39, who one year previously had had positive Kahn and Wassermann reactions and had received active antisyphilitic treatment. The osteomyelitis was diagnosed by the roentgenograms, and recovery followed radical surgical measures aided by transfusions and administration of sulfanilamide. The second case was that of a man of 22 who gave a history of trauma occurring seven months previously. Bilateral pansinusitis was present, and the patient recovered after two operations. In the third case, a boy of 19 who seemed to have acute ethmoiditis was operated on externally. Chronic osteomyelitis was diagnosed two months later and yielded to wide excision.

Emiliani and his associates [92] discuss the pros and cons of radical as against conservative treatment and come to the conclusion that conservative treatment carried on as long as possible will yield the best results, radical surgical treatment being reserved for as late a date as possible. In the case they report, the osteomyelitis was discovered in the course of an operation for the evacuation of an orbital abscess and the surgical treatment, thought at the time apparently adequate, proved to be insufficient. On the thirty-fourth day the patient returned with severe frontal headache, edema and high fever. Reoperation disclosed extensive extradural abscess with pachymeningitis. Recovery ensued, with marked deformity.

Richter's [93] case also demonstrates the course of the favorable type, which develops at a moderate pace following an earlier external operation on the frontal and ethmoid sinuses. Recovery followed extensive resection. It demonstrates how osteomyelitis may be developing slowly after an acute infection and be undiscovered at the time of the primary operation.

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91. Lewis, C. K.: Osteomyelitis of the Frontal Bone Following Sinusitis, Memphis M. J. **13**:27 (Feb.) 1938.

92. Emiliani, C. M.; Farjat, F., and Gerchunoff, G.: Consideraciones al margen de un caso curado de osteomielitis del hueso frontal post-sinusal a forma invasora con absceso extradural grande, Rev. oto-neuro-oftal. **12**:313 (Dec.) 1937.

93. Richter, H.: Ueber die Osteomyelitis des Stirnbeins, Hals-, Nasen- u. Ohrenarzt (Teil 1) **29**:346 (Sept.) 1938; Sitzungb. d. phys.-med. Soz. zu Erlangen (1937) **69**:343, 1938.

Gadolin [94] discusses the various methods of approach and lines of incision advocated by various authors. He proposes a cupid's bow incision which follows the supraorbital margin just below the hair line on each side, joined by a cross incision over the root of the nose. The curved incision may be carried down along the side of the nasal root for better exposure of the floor of the frontal sinus. Placing the incisions just below the hair line avoids a scar that frequently divides the growth of hair into two separate lines. The incision is similar to those described by Seyffert and Von Eicken. If necessary one may add an incision (coronal) just above the frontal hair line. He objects to a median incision because it disturbs regeneration of bone and impairs sensation. Incisions through the brow may interfere with the action of the frontalis muscle, and incisions in the temporal area may cut through fibers of the facial nerve and disturb the mimicry of the forehead. Wide disturbance of the periosteum as in laying down a large flap over the forehead predisposes to infection of the wound, in the author's opinion.

Lewy [95] reports a case of gangrenous granuloma of the cheek with osteomyelitis of the facial bones in a girl of 11. It began with a swelling in the nasolabial fold following scarlet fever. An intranasal antrostomy disclosed foul pus in the antrum. An ulcer developed alongside the nose. A Caldwell-Luc operation revealed a necrotic facial wall, granulations and pus. Histologic study showed only granulation tissue similar to that of syphilis. The Wassermann reaction was negative; no pathogenic fungi were found. Inoculation of guinea pigs yielded nothing conclusive. The facial wall gradually broke down; toxemia became more profound, and the patient died with pulmonary complications. An interesting observation in this case was the rapid growth of the child while in bed to a height of 6 feet (183 cm.), due no doubt to irritation of the pituitary gland.

Halle [96] maintains that in a case of petrositis in which he followed the infection through the middle ear and the carotid artery into the sphenoid sinus the primary condition was sphenoiditis which extended to the petrous apex and thence to the middle ear via the tubal cells. He bases his contention on the autopsy, which disclosed the old sphenoiditis and the fistula extending from the sphenoid bone to the petrous apex.

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94. Gadolin, H. R.: Zur Wahl der Operationsmethode bei Osteomyelitis des Stirnbeins, Ztschr. f. Hals-, Nasen- u. Ohrenh. **43**:283, 1938.

95. Lewy, A.: A Case of Gangrenous Osteomyelitis of the Paranasal Sinuses, Arch. Otolaryng. **27**:91 (Jan.) 1938.

96. Halle, M.: Review of a Case of Osteomyelitis of the Sphenoid Bone Extending to the Petrous Apex Through the Mastoid Process with Exenteration of the Middle Ear in 1900, Laryngoscope **48**:198 (March) 1938.

ORBITAL AND OCULAR COMPLICATIONS

Hirsch [97] says that if one asks a rhinologist he will say that orbital complications due to sinal disease are rare and if one asks an ophthalmologist he will answer just the opposite. The author finds that four fifths of all orbital complications are due to acute sinusitis and in their order of frequency the routes of infection are (1) direct, through intervening bone, (2) by way of the veins and preformed channels and (3) by way of the bony lacunas. As for optic neuritis he does not think the incidence is as great as is generally believed, since he can account for only 5 to 8 per cent of the cases on a rhinologic basis.

Gheorghiu [98] feels that there is a close relation between infections of the orbit and those of the nose and attributes it to a large extent to the direct continuity of the mucous membrane of the conjunctiva with that of the nose via the lacrimal apparatus. Of 100 infections of the orbit of nasal origin, 30 per cent were due to infection of the frontal, 20 per cent to that of the ethmoid, and 20 per cent that of the maxillary, sinus.

Nodine [99] classifies orbital complications into the following groups: (1) inflammatory edema of the lids, with or without edema of the orbit, (2) subperiosteal abscess with edema of the lids and orbit, (3) definite orbital abscess, (4) orbital cellulitis and (5) thrombosis of the cavernous sinus. The therapy outlined consists of (1) conservative treatment, i. e., packs, shrinkage and irrigation, (2) external incision for the evacuation of pus, (3) incision and drainage of the orbit, radical operation on the sinuses being unnecessary, (4) radical operation on the sinus, which may be indicated to decompress the orbit and permit drainage of fluid when no pus is present, and (5) prophylactic treatment.

The entire subject of orbital complications was thoroughly aired in a symposium before the Section of Laryngology of the Royal Society of Medicine.[100] Davis reported a series of 54 cases of edema of the orbit referred to the ophthalmic surgeons, in 72 per cent of which the condition was due to frontal sinusitis (mostly in adults) or ethmoiditis (in children). The abscess in most cases was subperiosteal, especially in the beginning. He mentions 4 cases in which the condition was due to trauma with resulting hemorrhage and infection. In 1 case fracture of the roof of the orbit resulted in frontal abscess, meningitis and death. In another case the condition followed a nasal operation with perfora-

97. Hirsch, O.: Nebenhöhlen und Auge, Wien. klin. Wchnschr. **51**:148 (Feb. 4) 1938.

98. Gheorghiu, I.: Orbital Complications of Infections of the Nasal Sinuses, Rev. san. mil., Bucureşti **36**:715 (Aug.) 1937.

99. Nodine, E. R.: Ocular Manifestations of Sinus Disease, J. M. A. Alabama **8**:172 (Nov.) 1938.

100. Discussion on Orbital Cellulitis Due to Sinus Infection, and Its Treatment, J. Laryng. & Otol. **52**:834 (Dec.) 1937.

tion of the orbital wall and subsequent cellulitis. When an orbital abscess is to be evacuated he advises suturing the lids together to protect the cornea. Thirty-seven of 39 patients were operated on by external incision plus nasal drainage. Thirty-four made a rapid recovery. One, previously operated on, already had meningitis and died. Another fatality was due to thrombosis of the superior longitudinal sinus. A third patient, an emaciated old lady, died of gangrene of the orbit. Mygind reported 86 cases observed at the Copenhagen Commune Hospital from 1923 to 1937, with a mortality of 16 per cent. External operation was performed in 46 cases, with 7 deaths. Twenty-four patients were treated conservatively, and all recovered. In some cases the nasal symptoms were minimal, which made the diagnosis difficult, and frequently roentgenograms were difficult to obtain on account of the pain and swelling. He asserts that no single symptom can differentiate a simple edema from a subperiosteal abscess. If the condition is doubtful, he believes, it is better to operate early, even if pus is not obtained, particularly if the symptoms are alarming. He advises also an incision adequate to permit inspection of the orbital wall. Capps stated, "A patient cannot be considered to have orbital cellulitis unless proptosis is present, indicating an intra-orbital phlegmon. . . ." He also advises incision when one is in doubt. Watson-Williams made a point in relation to the differentiation of subperiosteal abscess from true orbital cellulitis, that in the latter the bulb is pushed forward and chemosis is prominent. W. Stewart felt that the infective agent has much to do with therapy. If streptococci are present, with edema and high temperature, one should not operate early but should undertake medication with prontosil (form recommended not specified).

Fine [101] describes a case resembling one of aseptic thrombosis of the cavernous sinus, which in his opinion could only be designated as a case of "primary serous orbital cellulitis," since the condition resembled "serous tenonitis" as described in the ophthalmic literature. The latter, however, is circumscribed in the region of the ocular muscles, whereas the former involves all the orbital structures. The process is one in which there is a serous effusion into the orbit causing chemosis, swelling of the lids and the conjunctiva and severe pain over the frontal and maxillary regions but no fever or constitutional symptoms. Aspiration in his case revealed sterile fluid, and the leukocyte count was normal. Opening of the sinuses revealed no pathologic change, and the author believes that the condition was allergic. The treatment should be dehydration by intravenous administration of a 50 per cent solution of dextrose with magnesium sulfate by mouth and limitation of the intake of fluid.

101. Fine, A.: Primary Bilateral Serous Orbital Cellulitis, Ann. Otol., Rhin. & Laryng. **47**:370 (June) 1938.

Terracol and his associates [102] report a case of acute frontoethmoiditis with marked edema of the lids and conjunctiva and displacement of the bulb which receded under palliative treatment. They assert that the orbital reaction is due to vasomotor disturbance from involvement of the sympathetic nerve and is to be distinguished from orbital abscess by the pain, mydriasis, anesthesia of the cornea and impaired vision.

Wassenaar's [103] article is a brief discussion on the differential diagnosis of orbital tumors and abscesses.

Szolnoky [104] states that according to Verbely exophthalmos is due to one of two classes of disorder, those causing orbital stenosis and those causing orbital plerosis. In the first class are (1) exophthalmos dysplasticus, due to developmental errors, (2) exophthalmos hyperplasticus, due to uniform thickening of the orbital walls—these two have nothing to do with sinuses—and (3) exophthalmos paraplasticus, due to displacement of one of the orbital walls. Mucoceles of the sinuses belong to the last group. A typical case is cited. Acute processes cause exophthalmos by stagnation of secretion and swelling of the walls, with pressure on the orbital contents. As for orbital plerosis the authors mention hematoma from trauma or operation, emphysema, inflammatory processes and carcinoma. Much of the mechanics of both types of exophthalmos is discussed in the paper.

Sydenham [105] presents a review of the anatomic relations of the sinuses to the optic nerves and the orbits. Abnormalities of the ethmoid and sphenoid sinuses are shown which could account for early involvement of the visual apparatus. While citing other writers reporting large numbers of such complications, the author himself is more reticent. He recalls only 2 cases of neuroretinitis in which autopsy showed definite sinal infection. He records many cases of sphenoiditis with no ocular symptoms and seems to feel that precipitate intervention in a sinus without adequate findings is not justified.

Tseshinskiy's [106] report of 4 cases of retrobulbar neuritis seems to corroborate Sydenham's conservatism, because the records show that operations performed on the ethmoid and sphenoid sinuses revealed

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102. Terracol, Ybanez and Vergues: A propos d'un cas de sinusite fluxionnaire, Arch. Soc. d. sc. méd. et biol. de Montpellier **19**:92 (March) 1938.

103. Wassenaar, T.: Orbital Complications in Sinusitis, South African M. J. **12**:181 (March 12) 1938.

104. Szolnoky, Z.: Beziehungen zwischen Exophthalmus und Nasennebenhöhlen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **43**:215, 1938.

105. Sydenham, F. W.: The Richard Middlemore Lecture, 1937 [Relationship of Orbital and Optic Nerve Infection to Accessory Sinus Disease], Birmingham M. Rev. **13**:62 (June) 1938.

106. Tseshinskiy, A. I.: Surgical Therapy of Rhinogenic Retrobulbar Neuritis, Zhur. ush., nos. i gorl. bolez. **15**:159, 1938.

practically no pathologic change and in each instance the vision failed to return to normal. In case 1 four months after operation he reports vision 0.6, with atrophy of the optic nerve; in case 2 after four months the comment is "slow return of vision, relative central scotoma to red and white; vision stationary"; in case 3 he states, "the eyesight is not getting worse," and in case 4 he reports signs of neuritis considerably decreased.

Lemoine's [107] case resembled retrobulbar neuritis, but the condition was due to a lesion located back of the chiasm. The patient had hypertrophy of the prostate at 33 and impotence at 37. A diagnosis of deficiency of the anterior lobe of the pituitary gland was made. He improved under glandular therapy. A lesion of the right optic tract developed and progressed to complete loss of central vision in twenty-one days. Roentgenograms showed poorly ventilated sphenoid sinuses extending into the posterior clinoid processes. At operation a hemorrhagic area was found in the posterior wall of the right sphenoid sinus in the portion extending into the clinoid process and close to the superior portion of the optic tract, involving fibers corresponding to the defect in the visual field. After operation the vision and fields returned to normal. Six weeks after therapy the sexual vigor reappeared. The author's theory on this case is that the old infection of the sphenoid sinus involved the tract by direct contiguity as well as by absorption of toxins from the focus.

Teulières [108] favors the Rhese and Hirtz positions for roentgen studies and is inclined to be conservative in doubtful conditions. Otherwise he limits his surgical intervention to antrostomy, resection of the septum and middle turbinate and puncture or enlargement of the ostium of the sphenoid sinus. He is opposed to curetting the mucosa of the sphenoid sinus.

Strauss and Needles [109] feel that despite the frequency of multiple sclerosis, the cases of spontaneous recovery and the large percentage of the population having sinal disease and despite the frequent ill effects of surgical intervention there are still some cases in which operation is indicated. They rely on a careful examination by the otolaryngologist to determine the presence of sinal disease and advise operation if the visual impairment is progressive, even though in some of these cases the condition may later turn out to be multiple sclerosis. They have found typhoid vaccine a valuable adjunct in the treatment.

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107. Lemoine, A. N.: Lesion of the Optic Tract Probably the Result of Infected Sphenoid Sinuses, Arch. Ophth. **20**:966 (Dec.) 1938.

108. Teulières, M.: Les névrites optiques d'origine sinusienne, Progrès méd., Oct. 29, 1938, p. 1457.

109. Strauss, I., and Needles, W.: Optic Nerve Complications of Accessory Nasal Sinus Disease, Ann. Otol., Rhin. & Laryng. **47**:989 (Dec.) 1938.

Brault [110] reports a cure in a case of retrobulbar neuritis in which the sphenoid sinuses were opened by the Hirsch transseptal route. No suppuration was found, nor was the mucous membrane hyperplastic. He attributes the cure to improved ventilation, since he found the natural ostiums small.

Lagrange and Goulesque [111] had 2 cases of iridocyclitis in a patient with a positive Wassermann reaction. Specific therapy failed to influence the process, which yielded promptly, however, to drainage of an occult infection of the antrum and the ethmoid and sphenoid sinuses. They explain the dramatic cure on the basis of surgical interruption of an allergic cycle in which the reticuloendothelial elements had been responding to a bacterial allergy originating in the sinuses. This explanation accounts also for the resistance of the lesion to antisyphilitic treatment.

Jeschek [112] reports 4 cases of recurring iridocyclitis in patients ranging from 29 to 50, in whom sinal disease, such as suppurating maxillary sinusitis and ethmoid polyps, was present. Prompt recovery followed adequate surgical intervention. The author cites numerous authors but fails to mention Gill, whose articles on this subject are so complete.

In 3 of Nail's [113] cases definite pathologic change was found in the antrums and the sphenoid sinus, and prompt surgical intervention was followed by recovery of vision.

Steurer [114] reports a case of emphysema of the orbital conjunctiva following puncture of the antrum in a man of 61. The lids were not affected, nor was the bulb displaced. The author believes the condition was due either to a defect in the roof of the antrum or to a crack in the thin bone from the impact of the air. He discusses the various routes by which air may enter the orbit or palpebral apparatus and shows some sketches taken from the work of Heerfordt.[115] The chief point brought out is that the direction the air takes depends on whether it enters in front of or behind the septum orbitale.

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110. Brault, J.: Trépanation du sphénoïde par voie trans-septale dans un cas de névrite optique rétro-bulbaire: Guérison, Union méd. du Canada **66**:1225 (Dec.) 1937.

111. Lagrange, H., and Goulesque, J.: Irido-cyclite et infection focale: (allergic, système réticulo-endothélial, clasogénines), Ann. d'ocul. **175**:493 (July) 1938.

112. Jeschek, J.: Sinusitis als Ursache der Erkrankungen des Uvealtraktes, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:264, 1938.

113. Nail, J. B.: Sinuses as Foci of Infection, Texas State J. Med. **33**:572 (Dec.) 1937.

114. Steurer, O.: Ueber Emphysem der Orbita nach Kieferhöhlenspülung, Hals-, Nasen- u. Ohrenarzt (Teil 1) **29**:343 (Sept.) 1938.

115. Heerfordt, C. F.: Ueber das Emphysem der Orbita, Arch. f. Ophth. **58**: 123, 1904.

Novick [116] records 2 cases of paralysis of the inferior oblique muscle occurring a few days after a Caldwell-Luc operation. The diplopia was crossed instead of homonymous, because of preexisting exophoria. The condition lasted one month in the first case and a few days in the second. He attributes the complication to curetting of the anterior internal angle of the sinus, which is out of range of the operator's vision and which may be the site of a dehiscence.

INTRACRANIAL COMPLICATIONS

Courville and Rosenvold [117] made an extensive analysis of all the cases of intracranial complications that were found in a series of 15,000 autopsies at the Los Angeles General Hospital. The evidence shows that the sinuses are responsible for only a small proportion of these complications, only 51 in the entire series. In only one eighth of 337 cases could meningitis be traced to sinal origin. Acute sinusitis accounted for the condition in a large proportion of these. The article takes in a general study of complications in the brain due to infections other than sinusitis, including a discussion of avenues of transmission and of the pathologic pictures.

Hirsch [118] found 266 cases of endocranial complications in sinusitis over a ten year period, in 42 per cent of which the complications came from the frontal sinus, in 17 per cent from the sphenoid and in the rest from more than one sinus. Meningitis was due to sphenoiditis more frequently than to frontal sinusitis. The prognosis of meningitis was bad. In half of the cases abscess of the brain followed a preceding orbital abscess, and frontal sinusitis was the most common cause. He advises packing the cavity of an abscess of the brain and changing the pack at frequent intervals.

Sargnon [119] makes a comparison between intracranial complications due to sinusitis and those due to otitis media. Osteomyelitis, for instance, is more frequent among the former and more severe because of the frequent development of meningitis. Pachymeningitis and extradural abscess, on the other hand, are less frequent, and intervention is usually delayed because they are so frequently latent. When infection from a sinus passes beyond the dura it causes localized or generalized serous meningitis less frequently than does infection of

116. Novick, J. N.: Paralysis of the Inferior Oblique Muscle Following the Caldwell-Luc Operation, Arch. Otolaryng. **28**:412 (Sept.) 1938.

117. Courville, C. B., and Rosenvold, L. K.: Intracranial Complications of Infections of the Nasal Cavities and Accessory Sinuses: Survey of the Lesions Observed in a Series of Fifteen Thousand Autopsies, Arch. Otolaryng. **27**:692 (June) 1938.

118. Hirsch, O.: Nebenhöhlen und Gehirn, Wien. klin. Wchnschr. **51**:116 (Jan. 28) 1938.

119. Sargnon: Complications méningées des sinusites de la face, Avenir méd. **35**:114 (April) 1938.

otitic origin. Suppurative meningitis is prognostically more grave when of sinal origin, and the same applies to abscess of the frontal lobe because of late recognition due to lack of focal symptoms.

On the basis of a study of several cases and a review of the literature, Karbowski [120] can find no definite syndrome or combination of symptoms characteristic of subdural abscess whereby it can be differentiated from a cerebral abscess. He agrees with Hecquet that symptoms referable both to the meninges and the brain may be present at the same time. Meningeal symptoms may arise suddenly and disappear as quickly. Their reappearance, however, indicates diffuse inflammation of the subarachnoid space. Examination confirms the former observation; in the beginning the fluid is under pressure, cloudy and full of polynuclear cells. Gradually it clears and may even become normal because of resistance of the tissues and walling off of the infection. Another symptom of subdural abscess is the periodic remission of symptoms. The author maintains that frequently the course is like that of a subdural hemorrhage with recovery. In both instances, however, the process may reach a point at which the tissues are no longer able to withstand the pressure. This is manifested by a sudden exacerbation of symptoms, and frequently death ensues rapidly. The only two characteristic symptoms are aphasia and paresis of the extremities, these occurring only in more posterior lesions. Among the points of differentiation between subdural and cerebral abscess aside from those mentioned as focal are slowness of the pulse in the latter as against frequent tachycardia in the former and more frequent changes in the fundi. In only 1 of 44 cases of subdural abscess were changes in the fundi present.

Bertolet [121] reports the following case: A man of 44 fell on his nose and was rendered unconscious for a short period. No other ill effects were noted except temporal ecchymosis. He had been free from symptoms up to a year before examination, when a swelling appeared on each side of the nasion. Later headache and exophthalmos developed. Roentgenograms showed obliteration of bony detail, especially in the right frontal area, and destruction of the inner wall of the orbit. Preoperative diagnostic opinion was divided between mucocele, low grade osteomyelitis, tuberculosis and syphilis. At operation, when the incision was made, a mass extruded, and respiratory failure ensued, followed rapidly by death. Exploration revealed a cavity 7.5 cm. deep, filled with thick caseous and hemorrhagic material. Cultures were sterile. The author believes it to have been a sterile abscess although others felt that it was an old hematoma or broken-down cholesteatoma. Comment is made on the absence of symptoms (until late) in the presence of such extensive involvement of the brain.

120. Karbowski, B.: Weitere Beobachtungen an Subdural- bzw. Intermeningealabszessen, die als Komplikation von Nebenhöhlenerkrankungen auftreten, Monatschr. f. Ohrenh. **72**:512 (May) 1938.

121. Bertolet, J. A.: Atypical Massive Abscess of the Frontal Lobe, Arch. Otolaryng. **28**:621 (Oct.) 1938.

Langeron and Lagarde [122] report an abscess of the brain at a depth of 6 cm. in the frontal lobe which gave rise to symptoms rather late in the course of frontal sinusitis for which an external operation had been performed, with findings of "osteitis frontalis" due to staphylococci. The symptoms which led to the second operation and discovery of the abscess were psychic derangement, jacksonian seizures on the contralateral side, exaggerated reflexes, Babinski and Kernig signs and ankle clonus. The spinal fluid was under pressure and contained albumin and a few cells. The fundus was normal. Later there were general convulsions (right side), deviation of the eyes, grinding of the teeth and incontinence. At autopsy the abscess was found to have no capsule but to be surrounded by an extensive area of encephalitis.

Frotzel [123] states that the literature indicates that abscess of the frontal lobe occurs less frequently by direct extension than by retrograde thrombophlebitis. He cites a case of its occurrence by the latter route in a boy of 17, in which on the fifteenth day of acute frontal sinusitis the sinus was opened because of severe headache, vomiting and high fever. A subperiosteal abscess and local osteomyelitis were found. Relief lasted only a few days. With recurrence of symptoms a second operation was done, which revealed a necrotic posterior wall, tense discolored dura and a superficial abscess of the brain. Pneumococci and fusiform bacilli were recovered. The patient died four days later of progressive encephalitis.

Lefebvre and his associates [124] report 2 cases in which the condition resembled tuberculous meningitis but was proved to be due to aural or sinal infection. In the first case (both were cases of children), although no tubercle bacilli were found, the findings of lymphocytes in the spinal fluid, absence of bacteria, moderate temperature, delirium, ocular disturbance and gradual decline, all seemed to corroborate the tentative diagnosis of tuberculosis. Autopsy, however, revealed purulent meningitis, purulent otitis media and mastoiditis and purulent frontal and maxillary sinusitis. In the second case the condition was less severe and the patient recovered. Meningitis was present, with a preponderance of lymphocytes in the fluid. Fortunately, purulent ethmoid and maxillary sinusitis was discovered and promptly treated. The authors believe the meningeal symptoms were due to a simple lymphocytic meningeal reaction to adjacent infection.

122. Langeron, L., and Lagarde, L.: Abcès du cerveau secondaire à une ostéite frontale, J. de méd. de Paris **58**:141 (Feb. 17) 1938.

123. Frotzel, J.: Abscess of the Frontal Lobe Due to Acute Frontal Sinusitis, Časop. lék. česk. **77**:637 (May 20) 1938.

124. Lefebvre, G.; Minet, P., and Christiaens, L.: Deux cas de méningite seudo-tuberculeuse d'origine sinusale, Echo méd. du Nord **8**:641 (Nov. 21) 1937.

Teed [125] studied several series of reports of autopsies, totaling 28,400 autopsies, for the purpose of discovering how frequently an infection of the sphenoid sinus was the primary cause. He found only 7 cases in which the condition was rhinogenous as against 109 in which it was of otitic origin. He agrees with Eagleton and others that the spread to the endocranium takes place via the blood vessels. He collected 129 cases of meningitis reported in the literature as originating in the sphenoid sinus. He cites 4 cases personally observed, in all of which the patients were seen in coma and died. The prognosis is always bad because this condition is not diagnosed early. The symptoms are ill defined, but the author calls attention to glycosuria and mental disturbances as symptoms of particular significance. The importance of sphenoiditis in connection with meningitis may be gathered from the fact that while the sphenoid sinus is involved in only 15 per cent of all cases of sinusitis it is responsible for 35 per cent of all attacks of meningitis of sinal origin.

Sargnon [126] calls attention to the avenues by which infection of nasal or sinal origin may reach the large veins of the cranial cavity causing thrombosis and sepsis. Among these are (1) an inconstant ethmofrontal vein, connecting the nasal cavity directly with the superior longitudinal sinus, (2) an aberrant branch of the anterior ethmoid vein, by which the sinus communicates with the pituitary veins (he calls it "la veine du lobule orbitaire"), (3) dural veins perforating the dura, (4) diploetic veins, (5) superior cerebral veins and (6) anastomotic veins between the superior longitudinal sinus and the sinuses of the base, these being (*a*) Trolard's grand anastomotic vein, which runs along the fissure of Rolando receiving tributaries from the surface of the brain, especially in the frontal region, and (*b*) Labbé's anastomotic vein, located posterior to the former and connecting the lateral sinus with it or directly with the superior longitudinal sinus. Infection of the latter may be secondary to otomastoiditis by way of the venous sinuses of the base or directly from nasal sinusitis or orbitofacial infection. Although the symptoms are not characteristic he mentions the following as being at least strongly suggestive: (1) local pain, epistaxis and dilatation of the veins of the forehead (caput medusae); (2) septicopyemic symptoms, and (3) convulsions, hemiplegia and jacksonian attacks.

Kecht [127] claims that rhinogenic sepsis exclusive of osteomyelitic conditions is extremely rare, since he has been able to find only 9 cases in the literature in which the diagnosis was corroborated by the report

125. Teed, R. W.: Meningitis from the Sphenoid Sinus, Arch. Otolaryng. **28**:589 (Oct.) 1938.

126. Sargnon, A.: Les thrombo-phlébites encéphaliques par naso-sinusites, Avenir méd. **34**:300 (Dec.) 1937.

127. Kecht, B.: Ueber rhinogene Sepsis, Montschr. f. Ohrenh. **72**:395 (April) 1938.

of an autopsy. Twenty additional cases reported as cases of rhinogenic septicopyemia without positive evidence of involvement of cranial venous sinuses are rejected because the pathogenesis is not clear and because some of them occurred during an attack of influenza or scarlet fever in which the sinal disease was only a complication of a severe systemic condition. The author found 14 cases of true sepsis in a series of 2,000 cases of acute and chronic sinusitis in which admission to his clinic was made in twenty-five years. In half of these metastatic foci developed. He cites 2 cases in detail. In 1 the condition occurred in chronic ethmosphenoiditis with acute exacerbation. Intranasal operation was followed by septic symptoms and a large metastatic abscess in the gluteal region, which was opened ten days after the sinal operation. In the second case the condition followed grip; acute frontoethmoiditis was complicated by an orbital abscess, sepsis and meningeal symptoms. Autopsy revealed metastatic infarcts in both lungs, abscess of the cardiac muscle and other foci in the liver, spleen and kidneys.

25 East Washington Street.

(To Be Concluded)

News and Comment

AMERICAN LARYNGOLOGICAL ASSOCIATION

The following resolution was adopted at the final meeting of the American Laryngological Association:

"WHEREAS, It has become evident that in many communities and rural districts little or no attention has been paid by school authorities to disabilities affecting children, especially those resulting from disorders of vision, hearing and speech; be it

"RESOLVED, That the American Laryngological Association approves and recommends the provision of funds by foundations and other appropriate agencies to carry out adequate programs for the detection of visual, hearing and speech deficiencies which constitute a handicap or a threatened handicap to school children, and for providing through the cooperation of qualified specialists and of state, county and local medical societies appropriate medical care for indigent and underprivileged children who may be afflicted or threatened with such handicaps."

Abstracts from Current Literature

Ear

THE PREVENTION OF DEAFNESS. S. J. CROWE and JOHN W. BAYLOR, J. A. M. A. **112**:585 (Feb. 18) 1939.

This communication deals with one phase of the authors' investigation of the recognition and prevention of the commonest type of deafness and follows a preliminary report which was published in 1937. It is based on a detailed observation of 60 children, carried on in some cases for nearly ten years. This study is founded on the principle that a long-continued partial obstruction of the eustachian tubes causes retraction of the tympanic membranes, impaired hearing for high tones with relatively good hearing for low tones and sometimes a total loss of hearing by bone conduction and that the primary cause is hyperplastic lymphoid tissue around and in the pharyngeal end of the eustachian tubes.

This tissue is more susceptible to irradiation than are the adjacent epithelium, muscle and bone, as pointed out by Heineke in 1905, and the fact suggested to the authors that its surgical removal might be supplemented by follow-up use of radium and roentgen rays. With the aid and advice of Dr. C. F. Burnam, some ten years ago, the lymphoid elements around the eustachian tubes were treated with roentgen rays through portals near the angle of the jaw and with radium in an applicator small enough to pass along the floor of the nose, with the nasopharyngoscope in one side of the nose and the applicator in the other. Thus it was possible to place the applicator under visual control.

This technic was carried out in cases of (1) slowly progressive deafness beginning with the high notes, (2) recurrent attacks of otitis media in children with a tendency to lymphoid hyperplasia and (3) long-continued discharge from the ear after myringotomy or a simple or radical mastoidectomy.

Several case reports are cited, and audiograms and other details included. The doses for the various roentgen and radium treatments are clearly outlined. It is emphasized that doses of radiation should be small, so that no injury to the pituitary gland, nasopharyngeal mucosa or inner ear may take place.

The authors conclude that the most common type of middle ear deafness in adults begins during childhood, with such gradual progression that it is likely to be overlooked until it is too late. The middle registers (e. g., speech) are not involved. They feel that if school children in the primary grades were examined with a nasopharyngoscope once a year and those with hyperplastic lymphoid tissue in and around the orifice of the eustachian tubes were treated with radiation as often as necessary to insure normal functioning of the tubes the number of deaf adults in the next generation could be reduced by 50 per cent.

GORDON, Philadelphia.

INFECTION OF LABYRINTH WITHOUT SYMPTOMS IN ACUTE OTITIS MEDIA. B. KECHT, Monatschr. f. Ohrenh. **72**:1137 (Dec.) 1938.

The author reports the case of a man of 19 who acquired otitis media on the left side. The pus revealed hemolytic streptococci. In the fourth week of the acute otitis, mastoiditis was discovered, and tests revealed loss of function of the internal ear (deafness and no response to caloric and turning tests). As the patient's hearing was normal before the otitis media set in, the labyrinthitis apparently developed during the acute process. It was surprising that this labyrinthitis developed without dizziness. After a simple operation on the mastoid, followed by labyrinthectomy, the patient was cured. The writer believes that the infection of the internal ear occurred through the promontorium. LEDERER, Chicago.

FUSOSPIRILLOSIS AND MYIASIS OF THE EXTERNAL CANAL. A. MONTEIRO, Monatschr. f. Ohrenh. **72**:1162 (Dec.) 1938.

In a boy of 7 years the author found larvae of fleas within the external canal. By scratching, the boy infected the skin of the external auditory canal with fusiform bacilli and spirilla of Vincent. Consequently a large ulcer developed at the external auditory meatus. Intramuscular injections of bismuth were of no avail. Local administration of a paste of bismuth carbonate and olive oil was successful after removal of the larvae from the external canal.

LEDERER, Chicago.

RECOVERY FROM LABYRINTHOGENOUS MENINGITIS WITHOUT OPERATION ON THE LABYRINTH. G. TSIMEAS, Monatschr. f. Ohrenh. **72**:1168 (Dec.) 1938.

The writer describes 4 cases of purulent labyrinthitis in which recovery followed operation on the middle ear and mastoid process without opening of the labyrinth. In 3 instances the labyrinthitis followed acute exacerbation of chronic otitis, and in 1, acute otitis media.

LEDERER, Chicago.

SEDIMENTATION REACTION IN OTITIS MEDIA AND ITS COMPLICATIONS. P. FRENCKNER, Acta oto-laryng. **26**:309, 1938.

Frenckner, together with Hamberger, has followed all the cases of otitis media at the Sabbatsberg Clinic for a period of three years. His material consists of 1,341 cases of otitis or otitis with otitic complications uninvolved by the presence of any other disease which might affect the sedimentation rate to any marked degree. He also studied 147 additional cases in which otitis was complicated by such diseases as angina, bronchopneumonia, nephritis and polyarthritis. As a rule the sedimentation rate was taken every second day throughout the entire course of the disease. The studies were made partly according to Westergren's original method, called "macro" method, and partly by Strom's "micro" method from the finger tip. In many cases parallel tests with the two methods were made and the author found them fairly consistent.

He found little disturbance in the sedimentation rate in cases of chronic otitis, with or without complications.

In acute otitis the sedimentation rate rises in the first week or first two weeks in children and then gradually falls. In acute mastoiditis there is a speedy rise in the sedimentation rate, which then remains stationary for some weeks. In virulent mastoiditis or when a complication is threatening there is no stationary period but rather a continued rise. If this takes place, even in the absence of other symptoms, the author advises earlier operation.

The formation of abscesses or enclosed osteitic foci in the zygomatic or digastric region or in the pars petrosa causes a rise in the sedimentation rate, as do sinus thrombosis and meningitis. Labyrinthitis has little effect on the sedimentation rate.

A rise in the sedimentation rate accompanying or preceding a rise in temperature in the course of otitis, either before or after operation, is often due to an otitic complication. When the complicating condition is angina or some other intercurrent febrile disease, there is always first a rise in temperature and two to four days later a rise in the sedimentation rate.

A sedimentation rate of over 100 in an adult indicates almost without exception that the condition is operable. The same conclusion can be drawn with great probability in cases of children under 15 and with considerable probability in cases of infants.

GROVE, Milwaukee.

PATHOLOGIC AND CLINICAL STUDIES OF THE SO-CALLED ZYGOMATIC MASTOIDITIS. HAKAN R. GADOLIN, Acta oto-laryng. **26**:492, 1938.

In 957 cases of mastoiditis Gadolin found 74 cases in which the cells in the zygomatic process and in the anterior portion of the squama were involved.

Temporal cells were most usually encountered in cases in which there was an extensive cell system in the mastoid process. Such cells were also encountered fairly frequently in cases in which the pneumatization of the mastoid process had been arrested. Usually the temporal cell system connected directly with the general cell system of the mastoid, but in about one seventh of the cases there was compact bone between the two. Gadolin considers the zygomatic and squamal cells as terminal cells of cell paths originating from the walls of the auditory canal and the attic.

In 39 of the 74 cases of zygomatic mastoiditis the clinical picture differed from that usual in mastoiditis, and in the remaining 35 cases the special zygomatic symptoms were latent. The most common symptoms of zygomatic mastoiditis were pains in the temple, swelling and tenderness in the temple and the cheek, edema in the eyelids, pain on mastication and moderate trismus. A sinking of the upper anterior wall of the canal is a sign of great importance.

In one case pus from deep cells in the root of the zygoma penetrated into the mandibular articulation and into the cheek. Meningitic symptoms were often present, due to penetration of pus toward the dura. Systematic lumbar punctures made in a consecutive series of cases revealed a pathologic cell count and increased pressure in the cerebrospinal fluid in all but 10 of the cases observed. (The author does not say in how many cases this observation was made.) The most common intracranial complications were extradural abscess and meningitis; abscess of the brain occurred in 3 cases and symptoms of petrositis in 4.

Clinical diagnosis of zygomatic mastoiditis was often possible only after the appearance of symptoms due to cortical or epidural penetration of pus from the temporal cells. A normal roentgenogram does not preclude the presence of zygomatic cells. The frequent occurrence of intracranial complications renders the prognosis of zygomatic mastoiditis more grave than that of the more common variety.

Thorough exposure and drainage of the inflammatory focus in the temple require an elongation of the retroauricular incision forward toward the linea temporalis, and in searching for the focus one must remember that not infrequently it is entirely separated from the rest of the cell system by apparently sound, nonpneumatized bone and also that occasionally the cells extend to the extreme upper portion of the squama, to the most anterior part of the zygomatic arch and into the root of the zygomatic process as far as the aperture of the eustachian tube.

GROVE, Milwaukee.

MASTOIDITIS CAUSED BY PNEUMOCOCCUS TYPE III. EINO VAHERI, Acta oto-laryng. **26**:631, 1938.

Eino Vaheri studied 200 cases of mastoiditis in which operation was done in the university clinic at Helsingfors. He calls attention to the fact that the organism now known as Pneumococcus type III was formerly known as Streptococcus mucosus. Among Vaheri's material, 200 cases of mastoiditis, were 54 infections caused by the pneumococcus, and of these 48 or 24 per cent of the entire material, were due to Pneumococcus type III. The clinical picture of otitis and mastoiditis caused by Pneumococcus type III is well known. The initial symptoms are mild. The purulent discharge is of short duration or entirely absent. Only after a long time, sometimes months, do symptoms arise which denote involvement of the mastoid process. Before this there is a latent period, during which there are few symptoms but a steady destruction of bone. The infections were divided into the following types: the acute, in which there were 5; the subacute, in which there were 25, and the latent type, in which there were 15. The bulk of the infections, therefore, fall into the subacute or the latent type, in contradistinction to mastoiditis caused by the hemolytic streptococcus, which more usually assumes the acute form.

Vaheri's observations further indicate that Pneumococcus type III usually invades a bone which is well pneumatized and that it rarely occurs in mastoiditis

with poor pneumatization. This observation, he thinks, accounts for the fact that mastoiditis due to Pneumococcus type III is more prevalent in older persons in whom the cell system has expanded, than in younger. The fact that Pneumococcus type III so often invades a well pneumatized bone explains the frequency with which it involves the pars petrosa.

GROVE, Milwaukee.

Pharynx

BEHAVIOR OF THE WHITE BLOOD CELLS AFTER TONSILLECTOMY. G. PELLICCIA, Arch. ital. di otol. **51**:84 (Feb.) 1939.

Recently Pelliccia studied the effect on the blood picture of massage of the tonsils. The most important finding was leukopenia. Investigation of the effect of tonsillectomy on the blood was next undertaken on 15 patients, in 10 of whom massage of the tonsils before the operation had been carried out. As controls he used 5 patients who had had other operations comparable in gravity to tonsillectomy. In 3 of the controls, appendectomy had been done. He discovered marked leukocytosis with an increase of neutrophils in the tonsillectomized patients, reaching its maximum five to seven hours after the operation and return of the preoperative value after twenty-four hours. The variation in the number of lymphocytes was in inverse ratio to the variation in the number of neutrophils. Operative trauma or toxicoinfective factors played a small part in causing the changes in the blood, which are attributed to the sudden suppression of an action, perhaps endocrine, of the tonsils. This action, however, is shared by other aggregations of lymphoid tissue. The same effect was produced on the patients in whom the appendix was removed, but not on the other controls. The postoperative leukocytosis in cases of tonsillectomy was of brief duration because of the vicarious action of other lymphatic organs.

DENNIS, San Diego, Calif.

A DISCUSSION OF THE ACTION OF THE SOFT PALATE AND THE TUBAL ORIFICE DURING DEGLUTITION. THEODOR MOTLOCH, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:359, 1938.

The author reports a case of carcinoma of the upper jaw, in which, after operation, a large open cavity was revealed, extending into the nasopharynx and exposing the soft palate and the lateral and the posterior pharyngeal wall. He set up an unusual camera with special lighting facilities and was able to photograph the pharynx and eustachian orifice.

His observations were that during swallowing the soft palate moved upward to the posterior pharyngeal wall but that the posterior pharyngeal wall itself did not move. The plica salpingopharyngea moved backward and medially. The eustachian orifice (which normally had a craniocaudal slit) was widened, so that in its lower part it was flattened, and here there was a swelling below.

The widening was due to the action of the levator and the tensor veli palati muscle. The tensor muscle, which swings around the hamulus, spreads out in a radiating fashion into the aponeurosis of the soft palate, is united with the posterior membranous wall of the eustachian tube and, on contraction, draws the wall of this tube backward and downward, making it extend out horizontally. The levator muscle, the prominence of which also was noted below the orifice of the tube, assists in this action of widening the orifice and makes for better aeration of the eustachian tube.

PERSKY, Philadelphia.

THE SIGNIFICANCE OF ATYPICAL VEINS IN POSTANGINAL SEPTICEMIA. O. BRANKEL, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:432, 1938.

The author cites a case of septicemia following retrotonsillar infection complicated by phlebitis and thrombosis of the jugular vein. Tonsillectomy was performed with ligation of the internal jugular vein. This ligation was made 2 cm.

above the facial vein and about a fingerbreadth above the clavicle. The common facial vein also was ligated. However, the patient continued to have chills and within two days died.

The postmortem examination showed atypical distribution of the left anterior jugular vein, which extended from below upward to lead into the posterior facial vein, then into the tonsillar bed and, high in the neck, into the internal jugular vein. In consequence of the anomalous distribution, the sepsis came down from the tonsillar bed into the posterior facial vein and, instead of going into the internal jugular vein, continued down into the anterior jugular vein. That was perhaps the reason that the ligation of the internal jugular vein did not benefit the patient or affect the course of the disease.

In conclusion, the author states that if in the course of postanginal septicemia ligation of the internal jugular vein, the common facial vein and other veins in the operative field fails to produce improvement of symptoms, particularly if chills continue, one must suspect that thrombosis may have affected either the external or the anterior jugular vein, and these must be investigated at a second operation.

PERSKY, Philadelphia.

Larynx

PULMONARY COMPLICATIONS IN SURGICAL TREATMENT OF THE LARYNX AND PHARYNX. P. BROUSTET, Rev. de laryng. **59**:713 (Sept.-Oct.) 1938.

A lecture given in Prof. G. Portmann's course is summarized. The statistics from the French otolaryngologists are at variance with those obtained from other sources, particularly American. For example, 93 per cent of French otolaryngologists report that they have never seen any pulmonary complications following tonsillectomy. The author doubts the large number of complications reported in the American literature, although he admits the validity of the observations and the validity of the experimental work. The author notes the possibility of pulmonary infection following tracheotomy or partial or total laryngectomy or in the presence of a foreign body.

BATSON, Philadelphia.

HARMONIC VIBRATIONS IN LARYNGEAL THERAPY. J. TARNEAUD, Rev. de laryng. **59**:860 (Nov.) 1938.

For forty years vibration has been used as a method of treating laryngeal conditions. The subject of the present article is an apparatus which produces the eight frequencies of an octave from C-3 to C-4. This apparatus consists of an electric alternating current, an oscillator and an amplifier, with a simple electric applicator which transmits the emitted vibrations to the skin over the larynx. The keyboard allows a rapid change from frequency to frequency. The apparatus is especially recommended for aphonia due to psychomotor paralysis (hysterical aphonia) and for the psychasthenic vocal disorders of the singer. It is recommended for stabilizing the changing voice of the adolescent.

BATSON, Philadelphia.

HEMANGIOMA OF THE TRACHEA. LOTAR HOFMANN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:435, 1938.

The author reports the cases of 2 infants 2 months old, with hemangioma of the trachea. The symptoms, the clinical course and the pathologic picture were practically identical in each case. The peculiar type of stridor was characteristic of a laryngeal obstruction and seemed to improve on quiet respiration or sleep but became worse during any excitement or crying spell. The diagnosis was suggested by direct laryngoscopic examination. In addition, the author found evidences of hemangioma in other sites of the body.

He suggests local treatment and perhaps roentgen therapy or surgical intervention, but he doubts their value, since bronchitis and pneumonia may occur early and terminate the case.

PERSKY, Philadelphia.

Nose

THE NOSE IN CASES OF ASTHMA. J. COURBIN, Rev. de laryng. **59**:617 (July-Aug.) 1938.

The present status of knowledge of asthma, particularly as regards the symptoms in the nose, is reviewed. The nose as a "trigger area" is again emphasized. The usually practiced therapeutic procedures include topical applications to the nose, surgical treatment of the nose and desensitization by injections of protein. The author particularly emphasizes the good results obtained by visits to particular French watering places.

BATSON, Philadelphia.

A SUBPERIOSTEAL OPERATION ON THE FRONTOETHMOID SINUSES BY A COMBINED INTRANASAL AND EXTRANASAL TECHNIC. E. J. KAUNAS, Rev. de laryng. **59**:766 (Sept.-Oct.) 1938.

It is possible to drain the frontoethmoid sinuses successfully by an intranasal subperiosteal operation; however, in large sinuses extending far laterally the addition of an extranasal approach is necessary. Certain special instruments are recommended. For the most part these are the instruments commonly employed in radical surgical treatment of the sinuses, with the addition of the long-bladed retractors used in the external approach to the ethmoid cells. The patient is placed in the dorsal recumbent position, with the head slightly elevated. Local anesthesia is preferable. An endonasal 1.5 to 2 cm. incision is made along the bony margin of the piriform orifice. Through this incision the skin and periosteum are elevated from the bony bridge of the nose as far as the upper internal angle of the orbit. The lacrimal sac is carefully pushed out of the way. Similarly the mucous membrane is pushed away from this piece of bone on the nasal side, and the intervening bone in a narrow strip is removed in several steps, as follows: First, with the piriform orifice as a starting point a narrow strip of the ascending process of the maxilla is removed, care being taken to preserve the inferior orbital margin. Next, the resection of the upper part of the ascending process of the maxilla is attempted. This bone is much heavier, and its removal is more difficult. The third procedure is the resection and removal under the control of vision of the small but heavy orbital portion of the frontonasal plate. Any bone obstructing the free approach to the nasofrontal duct is likewise broken down. Next, the ethmoid labyrinth may be exenterated by working from before backward with the forceps or from posterior to anterior with a curet. The sinal labyrinth is now open for inspection, and the mucous membrane may be removed by curettage.

For large sinuses an extranasal approach is necessary. An incision is made along the lower margin of the eyebrow, limited to the outer half to protect the vessels and nerves coursing along the inner half of the brow. By elevating the soft part with the periosteum, an entrance is made into the floor of the frontal sinus at its lateral extension, and the exposure is continued to a point of junction with the endonasal opening. The entire sinus may now be curetted from the combined approach. This procedure has been carried out in 18 cases. The advantages claimed over the usual methods of Jacques and Jansen are as follows: A greater opening is made into the frontal sinuses; the final esthetic result is better; there is less postoperative pain. The author feels that the method should be used only with patients with large extensions of the sinuses. The procedure allows more attention to be given to the soft part, and the author feels that the good resuls obtained are due to the careful preservation of the periosteum and its close return to the denuded part. The preservation of the periosteum without trauma provides for adequate irrigation of the parts by the normal blood vessels.

BATSON, Philadelphia.

INFLUENCE OF THE METEOROLOGIC COMPLEX ON THE FREQUENCY OF EPISTAXIS. R. ABBATE, Arch. ital. di otol. **50**:689 (Dec.) 1938.

Abbate had previously studied the monthly and seasonal frequency of epistaxis in the quindecennial period 1921 to 1935 and found that the peaks of frequency occurred in winter (February), in summer (July) and in autumn (November), in the order of height. The present study was made for the purpose of determining what influence meteorologic factors during the same period may have had on the incidence of epistaxis. The only factors investigated were temperature, barometric pressure, storms, cyclones, winds, relative humidity and clear calms. It is shown that the cyclic course of epistaxis is in relation with the cyclic course of some of the meteorologic factors. The increase of epistaxis was found to coincide with the variations of temperature from the temperate mean values (15 to 20 C.); the greater the variation the higher the incidence of epistaxis. Epistaxis was intensified during the period in which the thermometer, after having reached a minimum, turned upward, or the reverse. A rapid fall of barometric pressure was also accompanied by an increase in the number of cases of nasal bleeding, especially when it coincided with the thermometric factor. The influence of the other factors was of minor importance and was partly dependent on that of the two mentioned. Physiologic facts offer a sufficient explanation of the observations recorded.

DENNIS, San Diego, Calif.

THE PNEUMATIZATION OF THE FRONTAL SINUS IN ATROPHIC RHINITIS WITH OZENA. HERMANN BARTH, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:135, 1938.

The author made a critical study of a series of cases of atrophic rhinitis and came to the conclusion that there is no positive evidence that atrophic rhinitis has any influence on the development of the frontal sinus. He traced the family history of 26 patients who had a suggestion of a hereditary element and found that there was no definite relation between ozena and the size of the sinus in any one family; that is, a mother and daughter might have a small sinus, while the son might have a large sinus.

Roentgenograms were made of 82 patients with atrophic rhinitis to determine whether the disease is associated with absence or poor pneumatization of the frontal sinus. Comparison with a control group of 300 normal roentgenograms of the frontal sinus suggested the possibility that with ozena the sinus may be slightly smaller, but the difference in size was too small to be conclusive. Hence the author concludes that the development of the sinus is not influenced by atrophic rhinitis.

PERSKY, Philadelphia.

THE AIR CURRENTS IN A HUMAN NOSE DURING RESPIRATION. J. SCHEIDELER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:228, 1938.

The author constructed a rather ingenious model of the nose, in which the turbinates could be easily removed. The walls were covered with calcium. He constructed also an apparatus with which a measured amount of air under different pressures can be either blown or aspirated through this model. The air contained ammonium chloride, and as it passed through the model of the nose, it etched its course on the calcium walls. In this way the author was able to trace the various air currents.

He noted that the air currents varied according to the amount of pressure going through the nose. A pressure of 128 liters per minute produced a current directed toward the anterior end of the middle turbinate. Here a small whorl was directed downward, which mixed with the main stream of the inspired air. The main stream passed in two equally large portions toward the upper border of the middle turbinate and the middle meatus, between the middle turbinate and the septum and then backward to the choana. If the pressure was less than 100 liters per minute, the stream was directed toward the agger nasi and then backward as in the foregoing observations, but a small portion produced a whorl in the vestibule

of the nose. Lowering of the air pressure still further not only lowered the arc of the major current of air but broke it up into an increasing number of whorls.

He then removed the inferior turbinate, and with an air pressure of 128 liters per minute he found that only a small stream of air flowed upward and directly back into the choana. The major portion of the stream struck the end of the middle turbinate and was then directed downward in a whorl toward the floor of the nose, where it stagnated for a while and then passed back into the choana.

When he removed the middle turbinate and left the inferior turbinate in place, he found a much larger stream of air going directly back into the choana and only a small portion being deflected downward. When he removed both turbinates, only a small portion formed an arc and passed to the choana; the larger portion was directed down toward the floor of the nose and there formed many whorls.

In conclusion, he states that when one or both turbinates are removed, the course of the air flow is definitely altered, with the formation of eddies or whorls either in the vestibule or toward the floor of the nose. In order to correct this, a greater amount of air pressure must be used to produce a sufficient amount of fresh air to pass back into the choana.

PERSKY, Philadelphia.

NASAL POLYPI AND EDEMA. MITTERMAIER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:239, 1938.

The author discusses nasal polyposis from the chemical standpoint. He found that the protein content of the serum ranged between 0.5 and 1 per cent, while the protein content of normal serum is about 7 per cent. This seems to speak against the thought that the polyp was formed by stasis of the fluid. He believes that it is probably due to greater permeability of the blood vessels.

He suggests a simple test to determine the allergic response in cases of polyposis. He injected 0.2 cc. of physiologic solution of sodium chloride intradermally. A small wheal was formed, followed by a secondary wheal. The secondary wheal disappeared in about six to twelve minutes. He measured both the size and the volume of this wheal. In persons with hyperplastic states who show a tendency to edema and polyposis usually the secondary wheal does not occur, and the primary wheal disappears in a much shorter time than six minutes. His conclusion is that persons who show a rapid resorption of the saline solution have a tendency toward polyposis, probably due to a certain degree of retention of salt in the skin.

In treatment, he suggests a salt-free diet leaning toward the alkaline side of the acid-base ratio and a careful avoidance of any evidence of acidosis.

PERSKY, Philadelphia.

Miscellaneous

EXPERIMENTAL STUDY OF THE RELATION BETWEEN THE LABYRINTH AND VOMITING. F. VENTURA-GREGORINI, Arch. ital. di otol. **51**:1 (Jan.) 1939.

A prominent theory of the cause of seasickness is that it arises from an abnormal excitation of the vestibular apparatus. It is not easy to explain the genesis of vomiting in seasickness, because the mechanism of the complex physiopathologic act of vomiting itself is still obscure. The cardial reflex has its seat in the pharynx and the upper part of the esophagus, the centripetal arc being formed by the glossopharyngeal and pneumogastric nerves and the centrifugal arc by the vagus. The cardial tonus plays an important role in the mechanism of vomiting; while it is easily inhibited by the act of swallowing, it opposes a marked resistance to regurgitation of the stomach contents, and a much stronger stimulus is required to relax it. Volenti assumed that, in the act of vomiting, a not negligible stimulus must be supplied by the propagation along the esophageal walls of antiperistaltic waves that arise in the stomach. By Volenti's method a graphic representation of the behavior of the cardial emetic tonus is obtained. Gregorini used this method in an experimental study on dogs to determine the

relation between labyrinthine stimulation and dilatation of the cardia. After laparotomy a glass tube was fixed in the wall of the stomach, behind which the pyloric end of the stomach was ligated. Attached to the tube was a recording manometer with a reservoir of fluid which could be raised or lowered to vary the endogastric pressure. The labyrinth was stimulated by means of galvanism and caloric irrigation of the inside of the bulla. The results of the experiments were that the cardial, emetic tonus was not modified by the labyrinthine stimulation. The author concludes that the hypothesis that excitation of the vestibular apparatus is directly the cause of vomiting in seasickness is not supported by the experiments.

DENNIS, San Diego, Calif.

MONONUCLEOSIS INFECTIOSA AND MENINGOENCEPHALITIS. VIGGO SCHMIDT and AAGE NYFELDT, Acta oto-laryng. **26**:680, 1938.

Mononucleosis infectiosa was originally considered an infection of the throat with a peculiar hematic picture. It is now known that it is a general systemic condition always recognizable by typical hematic changes and that it may frequently be associated with a disease of the throat. In addition to the symptoms in the throat there may be other complications, such as exanthems, hemorrhagic diathesis, albuminuria, icterus and, in isolated cases, serous meningitis and a form of encephalomeningitis. When this condition was orginally described it was not supposed to affect the central nervous system.

In the course of two months Schmidt and Nyfeldt diagnosed mononucleosis infectiosa in 5 cases. Two of the patients entered the clinic with a diagnosis of sinal infection and tonsillitis; the other 3, with a diagnosis of peritonsillar abscess. In 4 of the 5 cases there was definite pharyngeal and tonsillar involvement, with cervical adenopathy. As the first patient presented definite signs of meningitis, the cerebrospinal fluid of the other 4 patients was also studied, although they did not present signs of localization in the central nervous system on entrance. In these cases the early lumbar punctures did not reveal much change in the cerebrospinal fluid, but when the culture was repeated later, after subsidence of the fever and the angina, a much higher cell count was obtained. The differential blood count in all 5 cases showed a striking reduction in polymorphonuclear cells and a marked increase in the lymphocytic elements. Cultures of the cerebrospinal fluid revealed in 4 of the 5 cases a pure culture of listerellae. The observations in these 5 cases indicate that invasion of the central nervous system does occur in this condition, and usually late in the course of the disease.

GROVE, Milwaukee.

ATTACKS OF MÉNIÈRE'S DISEASE AND ATTACKS OF IRITIS TOGETHER WITH ANGIONEUROTIC EDEMA OF THE LIDS IN THE SAME PATIENT. K. O. GRANSTRÖM and C. O. NYLEN, Acta oto-laryng. **26**:717, 1939.

The authors present an interesting case, which tends to throw some light on the pathologic processes taking place in Ménière's disease. Their patient, a woman past 56, had presented for several years repeated attacks of the Ménière syndrome and also of palpebral edema of Quincke (angioneurotic), accompanied by iritis-like attacks of short duration. These were considered by the authors an "intraocular edema of Quincke," and the attacks of Ménière's disease were thought to be due to an analogous process in the labyrinth. All of the symptoms of this patient were considered allergic in nature, but a thorough allergic check-up failed to reveal the offending allergen. The patient was carefully examined between attacks and at such times was found to be normal in every respect, particularly in regard to the cochlear and vestibular mechanisms. During the Ménière attacks vertigo, rotary-horizontal nystagmus on change in the position of the head and a marked reduction of hearing in the left ear developed. The authors therefore assume that the "angioneurotic" edema affected both the cochlear and the vestibular end organ. Because of a positive Nonne reaction and a positive Pandy reaction of the spinal fluid they believe that the central portion of the auditory apparatus also was involved during the attacks.

GROVE, Milwaukee.

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

THOMAS W. LEWIS, M.D., *President*

Regular Monthly Meeting, April 3, 1939

WALTER H. THEOBALD, M.D., *Secretary*

NASOPHARYNGEAL FIBROMA. Presented by DR. STANTON A. FRIEDBERG.

This article will appear in full in a later issue of the ARCHIVES.

CEREBRAL EDEMA AS A CAUSE OF INTRACRANIAL HYPERTENSION OF OTITIC ORIGIN. Presented by DR. NORMAN A. LEVY.

The syndrome of increased intracranial pressure occurring during the course of middle ear suppuration but not associated with focal or diffuse intracranial inflammation is discussed. The signs and symptoms are those of intracranial hypertension, namely, headache, vomiting and papilledema, with absence of positive focal neurologic findings and the finding of normal cerebrospinal fluid under increased pressure. Differential diagnoses are set forth, and an extensive review of the literature is given.

The essayist reported in detail the case of a boy aged 10 in whom, as was indicated by the pneumographic and operative findings, increased intracranial pressure was due to an excessive amount of fluid in the brain itself rather than in the ventricles and subarachnoid spaces. In the literature, similar conditions with and without foci of suppuration in the temporal bone have been variously termed "serous meningitis," "hypertensive meningeal hydrops" and, rarely, "cerebral edema." It is suggested that the commonly accepted concept of otitic hydrocephalus is probably incorrect in many cases in which the term has been used, as the dilated subarachnoid channels and communicating hydrocephalus have not been demonstrated in most reported cases. Careful effort should be made to determine more accurately what type of intracranial disturbance is present. Should the hypertensive syndrome subside after simple lumbar drainage, it is suggested that the descriptive term "hypertensive syndrome" be applied. In cases in which there is no response to lumbar drainage and dehydrating measures, pneumographic studies (preferably ventriculographic) should be done.

In the case reported, persistent cerebral edema was found to be the cause of the intracranial hypertension, and the suggestion is offered that venous stasis due to infection in the dural sinuses might be the underlying cause. Cerebral edema may be a much more frequent cause of the otogenous hypertensive syndrome than is generally supposed.

DISCUSSION

DR. NORMAN LESHIN: For some years otolaryngologists have been confronted with a clinical syndrome associated with otitis media, which Symonds in 1931 suggested be termed "otitic hydrocephalus." The salient features of this syndrome are symptoms of increased intracranial pressure, namely, headache, vomiting and papilledema, without evidence of abscess formation and with spontaneous recovery. The pathologic nature was considered to be that of hydrocephalus due either to excessive secretion from the choroid plexus or to defective absorption from the arachnoid villi.

Now Dr. Levy has definitely shown that this clinical syndrome can be produced by cerebral edema and that the pathologic background cannot be accurately determined unless thorough air studies are made. It is of great interest, further, to note in the literature that most of the cases reported in which air studies were made small ventricles were revealed instead of dilated ventricles as one would expect to find in cases of hydrocephalus. In spite of this finding, both the concept and the title of this syndrome have remained unchanged.

Now there is presented a pathologic condition, cerebral edema, which can explain both the symptomatic complex and the pneumographic findings, as shown by Dr. Levy in this report of a case with pneumographic studies and, on cerebral decompression, visual confirmation of the diagnosis of edema. It is peculiar, however, that in a fair number of reports of such cases in which subtemporal decompression was done the observers made no mention of cerebral edema. Davidoff and Dyke reported having done subtemporal decompression in 13 of their 15 cases of this type, without emphasizing cerebral edema. This may have been simply an oversight. On the other hand, it is still possible that this clinical syndrome may be produced by other types of pathologic involvement, as hydrocephalus, arachnoiditis or even a lesion of the posterior fossa. With these possibilities in mind, in cases in which the symptomatic picture is fundamentally the same it appears that air studies may be essential to determine the underlying pathologic changes. In those cases in which several spinal punctures clear up the condition, nothing further is required. On the other hand, when the syndrome persists, further investigative measures are necessary, as shown by Dr. Levy.

The causative factor for this condition is not necessarily otitis media. In 2 cases the syndrome followed sore throat, and in 2 others it followed an infection of the upper respiratory tract. In some of the cases a relapse followed an infection of the upper respiratory tract. However, the large number of cases in which it has been associated with an involvement of the lateral sinus ranging from phlebitis and perisinal abscess to thrombosis of the sinus must place the condition definitely as one of the otitic complications.

The therapy has been, essentially, repeated spinal drainage and, with an obstinate condition, decompression. The papilledema gradually disappears over a period ranging from a few months to several years. In cases in which the headaches return, they usually respond to spinal drainage alone.

Dr. Levy has shown the necessity for further study of this condition when both the etiologic and the pathologic features are in doubt. Pneumographic studies seem to be a definite step in the direction of an accurate diagnosis. Otologists who may be confronted with this condition should avail themselves of complete neurologic cooperation in an attempt to solve the problem.

Dr. Levy has made a noteworthy contribution to knowledge of this subject. He has shown the necessity of pneumographic studies, and his suggestion for changing the name of this syndrome should be seriously considered.

DR. HANS BRUNNER: The paper was very interesting, and I entirely agree with Dr. Levy that the conception of "otitic hydrocephalus" as Symmonds described it has not been proved by the author to fit the facts. I personally have never been convinced by the deductions of Symmonds, although I have not been able to make an exact diagnosis in those cases of "otitic hydrocephalus" which I have observed. Undoubtedly it portends great progress that Dr. Levy stressed the importance of encephalography in such cases. From the encephalographic examination in his own case Dr. Levy draws the conclusion that he had to deal not with hydrocephalus internus but with edema of the brain, because the ventricles of the brain had a normal size and configuration and because following the subtemporal decompression the brain was found moist and edematous. I cannot quite agree with the last conclusion. Provided that the ventriculographic examination was performed prior to the subtemporal decompression, one would expect that the ventricles would be narrower than normal in a case of edema of the brain. One must imagine that the brain when it suffers from acute edema becomes

larger. By this increase of size it would partly obliterate the arachnoidal spaces, but it would also bulge out into the ventricles. Consequently the size of the ventricles would be expected to be narrower.

However, it is only of theoretic interest whether the interpretation given by Dr. Levy is correct or not. From the practical standpoint, of greater importance are two other questions: 1. How can these cases be differentiated from those of abscess of the brain? 2. How should the patients be treated? So far as the first question is concerned, three points seem to be of importance: 1. Patients with edema of the brain are usually children or juveniles. 2. In cases of "brain edema" there frequently can be noticed a sudden development and a rapid increase of choked disk, so that the papilla is elevated from 5 to 6 diopters within a few days. Such a rapid swelling of the papilla occurs neither with abscess of the brain nor, as a rule, with tumor of the brain. 3. Such patients do not give the impression that they are seriously ill, despite the marked changes within the eyegrounds, as already pointed out by Dr. Levy.

As far as the treatment is concerned, I have learned to be conservative in these cases. When mastoiditis is present, the simple mastoid operation is performed and the dura, particularly that of the middle fossa, widely exposed. When there are signs of an infection of the sinus, both the sinus and the dura of the posterior fossa are exposed. Lumbar puncture is performed but not repeated too often. To date I have never been forced to do a further decompression of the brain. However, it is necessary that the physician should not become too apprehensive, since it sometimes takes many days for the choked disk to subside. The physician has to bear in mind that in these cases, as well as in those of abscess of the brain, choked disk seldom changes into secondary atrophy of the optic nerve, as it frequently does in cases of tumors of the brain.

Dr. R. H. Good: Eighteen years ago I read a paper before this society on the subject of abscess of the brain and irritation of the brain, and I showed then the symptoms of hypertension which arise from extradural irritation caused either by pus or by toxin. No matter where this necrosis is, it provokes hypertensive symptoms. When one exposes the dura the symptoms disappear, except when the abscess occurs over the lateral sinus. In this case, with the abscess producing either parasinusitis or thrombosis, one sees these symptoms of hypertension reappear and continue for a long time. I object to spinal punctures in the treatment of hypertension in such cases.

When I presented this paper Dr. Beck had just come back from the war, and he discussed it and said that it was a "wonderful pedagogical paper" but that he did not think there was anything in the subject.

Dr. Joseph C. Beck: I want to recall to Dr. Good that when he presented that paper I attacked it, and he should have given vent to his feelings against me, because Dr. Rogers, who was associated with him in that paper, was the surgeon. I certainly was opposed to the attitude which these gentlemen took toward so many operations based on the symptoms alone and not on findings. At that time roentgenography was in its infancy, and all one saw on the glass negative was a blur. One must not confuse the present time with the past so far as the knowledge of this condition is concerned. I am sure the society appreciates Dr. Levy's study of this 1 case and his references to the literature as a whole.

Dr. Norman Levy: I wish to thank all the discussers. In reply to Dr. Smiley and Dr. Leshin, Davidoff and Dyke did not emphasize cerebral edema in their cases. They described it but did not emphasize it. They found an abnormal amount of cerebrospinal fluid over the convexity, but they also found the underlying brain to be edematous. My idea is that it was the edema that was probably responsible for the small size of the ventricles which they uniformly found.

In reply to Dr. Brunner as to why the ventricles should not be smaller than usual, I cannot explain why. I can only state the findings. In the case I have described the cerebral edema was not hypothetic. It was proved to be present when the decompression was done. I agree with everything Dr. Brunner said about the differentiation from abscess. I think it is dangerous to wait too long

under certain conditions in the presence of papilledema. One must test the visual acuity and the visual fields frequently, because there may be changes secondary to those in the optic disk and permanent change in the acuity. If the impairment of visual acuity is progressive, subtemporal decompression should be done, because a very rapid change can occur in the course of a week or ten days.

In regard to Dr. Good's objection to spinal puncture, I can say only that in the majority of cases this cures the patient, and inasmuch as no harm is done, I can see no objection.

SIMPLIFIED CONSTRUCTION OF FACIAL MOLDS AND PROSTHESES. (Demonstration with Colored Movies and Models). Presented by DR. SAMUEL PELUSE.

The technic of making facial molds (life masks) as perfected by Dr. Fox and the essayist in the past two years was shown. The making of life masks is an essential adjunct to reconstructive surgical operation on the face and the construction of prostheses. The masks are accurate three-dimensional reproductions of the patients' faces and lend themselves to preoperative study, measurement and planning.

The models demonstrated were of wax and rubber. Wax models are hard to handle and difficult to store and are made only when a model has to be made rapidly. Liquid latex rubber is ideal for making models, as the resultant product tolerates rough handling and will not deteriorate. Of interest are the reproductions of temporal bones that have been operated on. In 2 models the exposed dura is represented, and when the model is palpated one gets the sensation of feeling the real dura. These models lend themselves very well to teaching purposes.

DISCUSSION

DR. JOSEPH C. BECK: I want to compliment Dr. Lederer on having developed the method to this perfection. It would be too bad to let this demonstration go without discussion. I have had a good many years of experience in making models for repair of defects about the face. My associates and I have done a good many things along the line of prosthesis with excellent results. This exhibit is wonderfully demonstrative—particularly of the pathologic character of the tissues involved. One cannot get by the appearance what can be obtained by the feel—for instance, in the temporal bone specimens it is possible "to palpate the dura." These models are very important and are interesting from the standpoint of operators. One may also have gross specimens reproduced to show pathologic features. The registry in Washington is very short of gross pathologic material, and this is going to fill a great need in working out these problems.

Dr. Peluse is to be congratulated on this work, which is much needed by otolaryngologists and others who are interested in radical exenteration of sections of the face in the treatment of malignant growths or trauma; they can have something to show the patient as to the end result when so much tissue has to be sacrificed.

DR. FRANCIS LEDERER: I rise to say that I cannot accept credit for this presentation. The work was done by Drs. Fox and Peluse with the help of Mrs. Peluse. My interest in this type of work goes back a number of years to prostheses (Lederer, Francis L.: Prosthetic Aids in Reconstructive Surgery About the Head: Presensation of a New Method, ARCH. OTOLARYNG. **8**:531-534 [Nov.] 1928) as well as to material for teaching. In this regard, this work has filled a great need in the department of otolaryngology. Dr. Peluse is now making it a part of clinical teaching. Some may feel that such work is purely a technician's work, but I think it is important that otolaryngologists create an interest in this type of work, because it is an essential part of their specialty, not only from the point of view of teaching but also from that of replacement where there are gross defects. The period devoted to this was so short that many details were left out, but the exhibit is well worth study. Aside from the clinical application, the making of models is economical. The models are produced at small cost, are not easily broken and can be preserved.

Book Reviews

Diseases of the Nose and Throat. By Charles J. Imperatori, M.D., F.A.C.S., and Herman J. Burman, M.D., F.A.C.S. Second edition, revised. Price, $7. Pp. 726. Philadelphia: J. B. Lippincott Company, 1939.

The second edition retains the general plan and format of the first. Here and there a thorough revision of a chapter has been made because of the greater knowledge of the condition discussed accumulated during the past several years. An enormous amount of material is compressed in the 726 pages that this volume contains.

The authors again depart from the usual textbook description of disease by discussing first the symptoms, diagnosis and treatment and concluding with the pathology, prognosis, etiology and prophylaxis. Throughout the text they have endeavored to present the material in a clear, concise and comprehensive manner, in all of which, it is evident to the reviewer, they have admirably succeeded.

General systemic diseases with rhinologic manifestations are covered in twelve pages, allergic diseases in ten and laboratory aids in thirteen, and fuller discussions of hemorrhage of the nose and throat and particularly of postoperative submucous resection and tonsillectomy are presented. Descriptions of many of the recent advances have been added to the sections on the nose, and additional material will be found in the parts dealing with diseases of the oral cavity.

The accomplishments of the authors make this textbook authoritative. It is recommended to medical students, general practitioners and otolaryngologists and to specialists in subjects closely related to diseased states in the nose and throat.

Directory of Otolaryngologic Societies *

FOREIGN

Collegium Oto-Rhino-Laryngologicum Amicitiæ Sacrum

President: Dr. Louis Ledoux, Brussels, Belgium.
Secretary: Prof. Dr. C. E. Benjamins, Verlengde Heereweg 143, Groningen, Netherlands.
Place: Brussels, Belgium. Time: September 1939.

Hungarian Otolaryngological Society

President: Dr. V. Zimányi, Zárda-u. 48, Budapest II.
Secretary: Dr. G. Kelemen, Reáltanoda-u. Budapest IV.

Sociedad Rioplatense de Oto-Rhino-Laringología (Argentine Section)

President: Dr. Raul Becco, B. Mitre 1690, Buenos Aires.
Secretary: Dr. Juan Manuel Tato, Santa Fé 1171, Buenos Aires.

Société Française d'Oto-Rhino-Laryngologie

Secretary: Dr. Henri Flurin, 19 Avenue Mac-Mahon, Paris, 17e.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. A. W. Proetz, 3720 Washington Blvd., St. Louis.
Secretary: Dr. Leroy A. Schall, 270 Commonwealth Ave., Boston.
Place: New York. Time: June 10-14, 1940.

American Academy of Ophthalmology and Otolaryngology

President: Dr. George M. Coates, 1721 Pine St., Philadelphia.
Executive Secretary: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.
Place: Chicago. Time: Oct. 8-13, 1939.

American Bronchoscopic Society

President: Dr. Lyman Richards, 319 Longwood Ave., Boston.
Secretary: Dr. Paul H. Holinger, 1150 N. State St., Chicago.

American Laryngological Association

President: Dr. James A. Babbitt, 1912 Spruce St., Philadelphia.
Secretary: Dr. Charles J. Imperatori, 108 E. 38th St., New York.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC.

President: Dr. Lee M. Hurd, 39 E. 50th St., New York.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester, N. Y.
Place: New York. Time: June 1940.

SECTIONS:

Eastern.—Chairman: Dr. John R. Simpson, Medical Arts Bldg., Pittsburgh.
Place: Pittsburgh. Time: January 1940.
Southern.—Chairman: Dr. Walter J. Bristow, Doctors Bldg., Columbia, S. C.
Place: Columbia, S. C.: Time: January 1940.
Middle.—Chairman: Dr. Sam E. Roberts, Professional Bldg., Kansas City, Mo.
Place: Kansas City, Mo. Time: January 1940.
Western.—Chairman: Dr. Pierre Viole, 1930 Wilshire Blvd., Los Angeles.
Place: Los Angeles. Time: January 1940.

AMERICAN OTOLOGICAL SOCIETY

President: Dr. Horace Newhart, 527 Medical Arts Bldg., Minneapolis.
Secretary: Dr. Thomas J. Harris, 104 E. 40th St., New York.